The Electrical Industry's Weekly Magazine

April 30, 1956

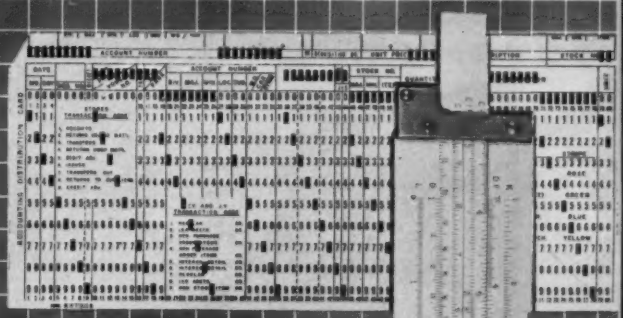
Electrical World

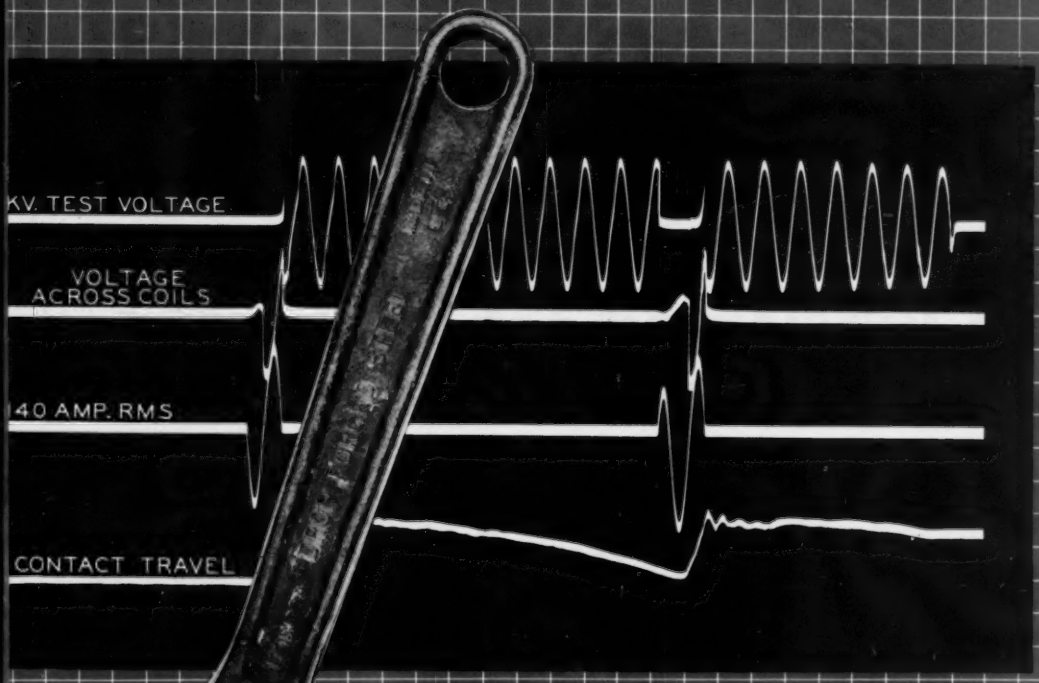
Price 35 Cents

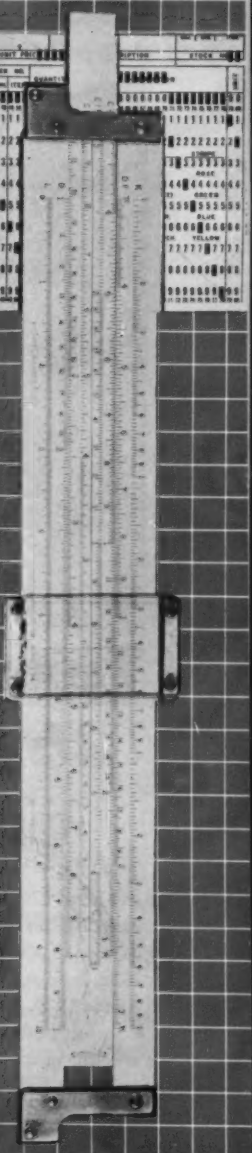
A McGraw-Hill Publication

A Special Report:

Organizing Planning and Applying...







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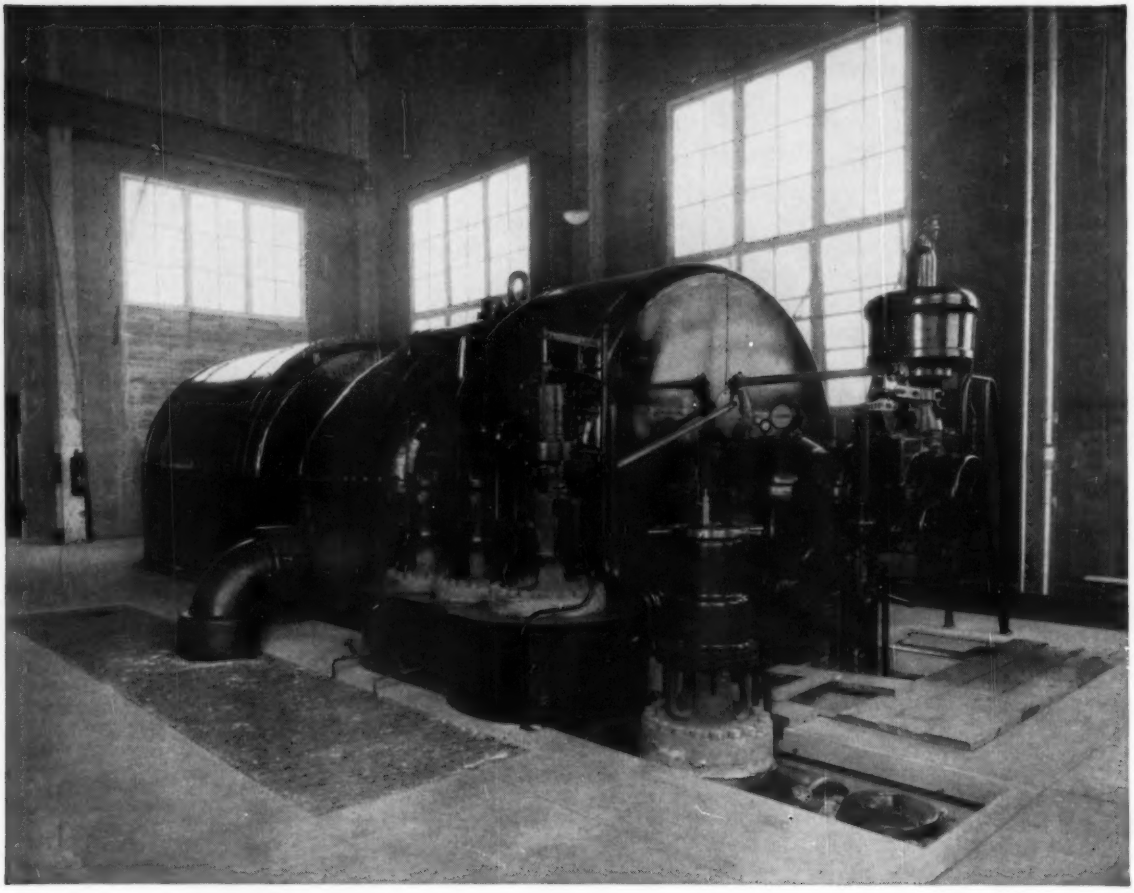

Texaco-lubricated for 26 years . . . still on original bearings

Miami Copper Company, Miami, Arizona, has every reason to be proud of this 15,000 kw. Westinghouse turbine. Its output, since it went on the line in 1929, is in excess of two billion kilowatt hours and original bearings are still in use.

Mr. W. H. James, Miami's Power Plant Superintendent, ascribes this to careful maintenance procedures and the fine protection given by *Texaco Regal Oil B* which has been the only lubricant used.

In 1935 the original fill of Regal Oil B was replaced by new oil as a routine measure; this oil has been in service since that time with no replacement except "for sweetening" with periodic make-up. The oil is in perfect condition today.

Texaco Regal Oil has been a world-famous turbine oil for decades. *Texaco Regal Oil R&O* is the same fine oil with the added advantages of effective rust, oxidation and foam inhibitors.

A Texaco Lubrication Engineer will gladly give you full information. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, New York.

TEXACO

TEXACO Regal Oils R&O

FOR ALL TURBINES

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ELECTRICAL WORLD

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Electrical World

Published for 82 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

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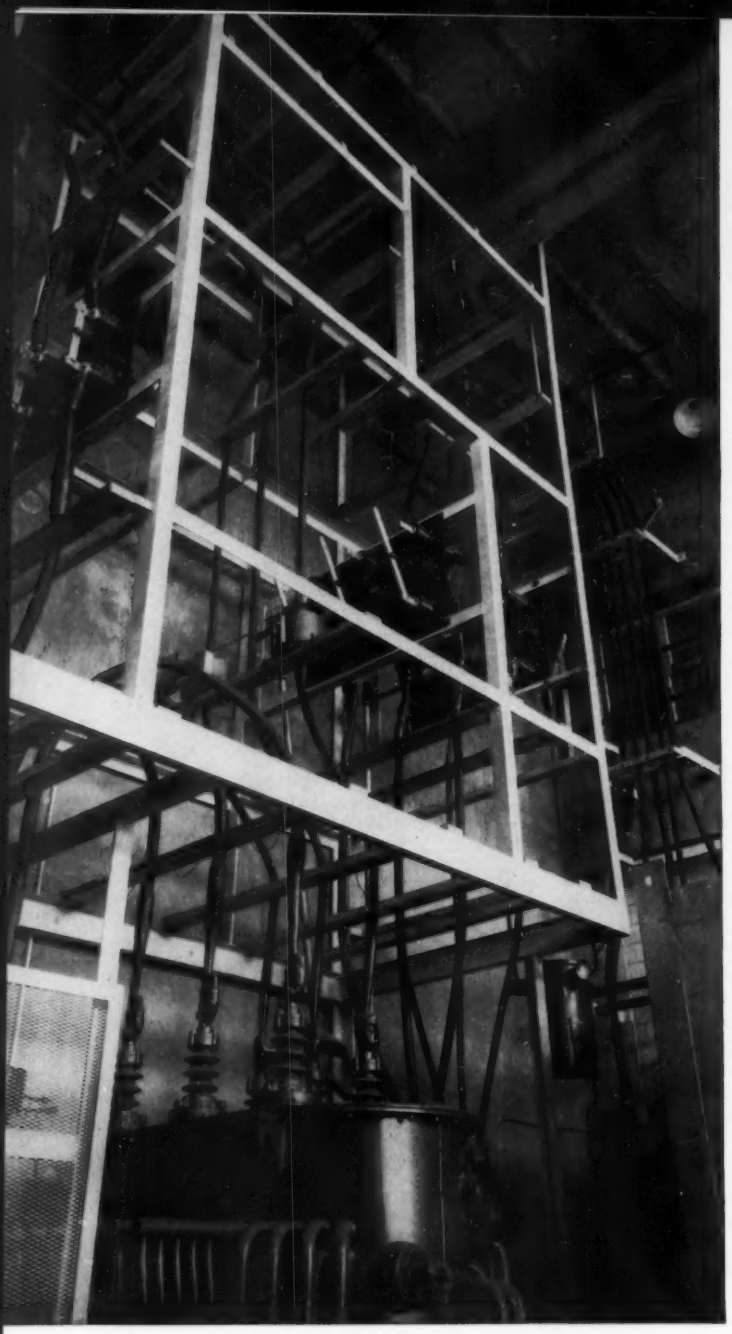


Okolite-Okoprene 15kv and 5kv cable installed in the Moloney Electric Company's new testing laboratory. The fabricating plant is also wired with Okolite-Okoprene. Gamp Electric Company, St. Louis, Missouri, made the electrical installation.

why MOLONEY ELECTRIC uses OKONITE cables

For their St. Louis plant, Moloney Electric chose Okolite-Okoprene cables—not only for supplying power in their production department, but also for testing their large power transformers. In manufacturing operations of this important nature, the electrical circuits must have two major characteristics—reliability and long life. Here is detailed proof that Okolite-Okoprene cables fulfill these requirements:

1. Okolite insulation's established service record of more than thirty years standing has demonstrated its continued high dielectric strength at a-c voltages up to 35kv and d-c voltages up to 150kv.

2. Okoprene, developed in 1932 by Okonite engineers, has proved its durability as a mechanically rugged and weatherproof protective sheath through use on portable cables in open pit mining operations.

3. Both Okolite and Okoprene are applied by the strip-insulating process which assures metal mold-cured cables, with full, uniform walls of insulation.

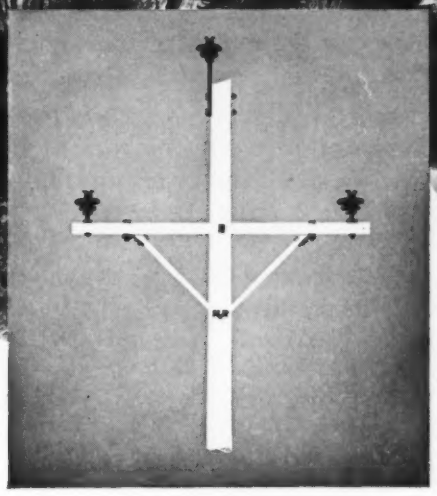
4. Okolite-Okoprene cables have wide use in both control and power circuits for all voltages up to 35kv in conduit, underground duct, direct burial, aerial and submarine installations.

If you do not have in your files complete engineering information on high and low voltage rubber-insulated cables, including dimensions, current carrying capacities, and splicing and terminating information, just write for manuals EW-1075 (5kv to 35,000 volts), and EW-1085 (up to 5,000 volts), to The Okonite Company, Passaic, New Jersey.

Available with either copper or aluminum conductors

3262

OKONITE SINCE 1878 *insulated cables*



Type 401
Triangular structure*

Quantity	Description
1	Crossarm
1 pr	Wood crossarm brace
2	Washerhead bolt ½" w/sq. nut and flanged 3" x 3/16" washer
3	Pin type insulator
1	Curved shouldereye bolt ⅝" w/washer
2	Crossarm pin long shank
3	Machine bolt ⅝" w/locknut
2	Curved washer 2¼" sq.
1	Washer 2¼" sq. x 3/16", 13/16" hole
1	Spring washer ⅝"

This print was reproduced from the Graybar Bulletin GB-507&A on High Voltage Transmission Line Materials. This 92-page book covers, in condensed form, Graybar materials for transmission line construction. Write us, if you do not already have your free copy.

From Bolts to Brush Killer — it Pays to Order via Graybar

When you build transmission or distribution lines – whether a few hundred yards or a hundred miles – there's a simple way to fill *all* your material and supply requirements. Just order *via Graybar.*

Location makes little difference – there's always a Graybar office or warehouse as near as your telephone. You can get product and performance data on more than 100,000 different electrical items and the help of experienced Graybar Outside Construction Specialists in solving unusual problems.

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CALL GRAYBAR FIRST FOR... Everything Electrical

IN OVER 130 PRINCIPAL CITIES

ARE YOU SECTIONALIZING YOUR FEEDERS AT

Now the simpler operating methods possible with S&C Load Interrupters can save equipment costs at sectionalizing points by almost one half.

S&C Load Interrupters can switch the circuit *without any external arcing.*

This means you can now use stick operation at many points where the present practice is group operation . . . group operation perhaps for the single purpose of actuating disconnects or horn-gaps when mounted upright at pole-top locations to give the necessary clearances for their rising arcs.

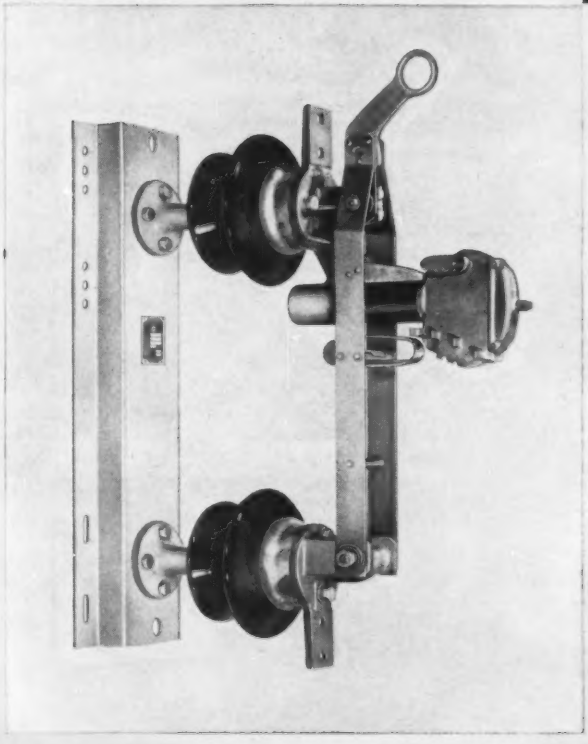
With the stick-operated* Load Interrupter, you actually save three ways: (1) No costly operating mechanism and pole-top frame to purchase; (2) Installation labor radically lowered; (3) Maintenance and adjustment costs reduced to a minimum.

Of course this cost-saving is just part of the story. Since the Load Interrupter can switch the circuit under any condition except short circuit, it permits completely new practices in switching distribution feeders.

**However, S&C Load Interrupters may also be obtained for group operation.*

Would you like to read more about the S&C Load Interrupter and how it saves money while improving operating practices? Write today for Catalog Section 760.

DISTRIBUTION LOWEST COST?



Inverted Interrupters are readily accessible for operation with a hook stick.

Single-pole Load Interrupters for vertical mounting—14.4 kv 600 amp.

S&C ELECTRIC COMPANY

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POWER FUSES • DISTRIBUTION CUTOUTS AND FUSE LINKS • LOAD INTERRUPTERS • METALCLAD SWITCHGEAR

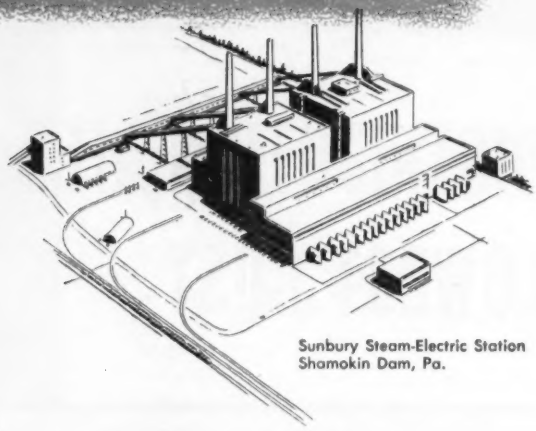
Specialists in High-Voltage Circuit Interruption

PENNSYLVANIA POWER & LIGHT COMPANY

. . . an *exclusive* user of Grinnell prefabricated piping for 16 years

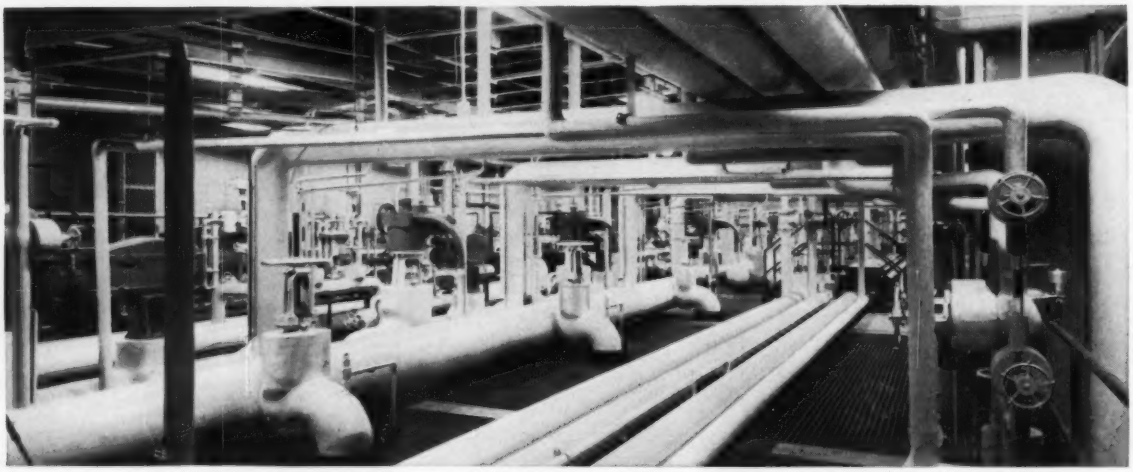
Since 1940, Pennsylvania Power & Light Company has awarded *all* its prefabricated piping work to Grinnell. Some idea of the extent of this confidence in the competence and skill of Grinnell piping specialists can be drawn from the fact that during this 16-year period there were 8 new units installed — with a total capability of close to 800,000 kw's.

Among other companies in the power field which have indicated a marked preference in the past for Grinnell Piping Products are Duke Power, a Grinnell Prefabricated Piping user for 44 years; New England Electric System, a 6-year, 6-time repeat customer; and Carolina Power & Light, a 7-year, 7-time Grinnell repeat customer.



Sunbury Steam-Electric Station
Shamokin Dam, Pa.

Where some of the 4,500 individual fabricated piping assemblies made by Grinnell were installed at the Sunbury Station.



The big jobs in power piping go to Grinnell because Grinnell's shop facilities offer these practical advantages . . . superior quality of finished product; faster "on the job" assembly; lower final cost. Assign *your* next piping job to Grinnell.

Work done by Grinnell for Pennsylvania Power & Light Company

1940-41 . . . . Cedar Station, Unit #6
1941-42 . . . . Hauto Station, Unit #6
1949 . . . Sunbury Station, Units 1 & 2
1950 . . . . Sunbury Station, Unit #3
1953 . . . . Sunbury Station, Unit #4
1954 . . . Martins Creek Sta., Unit #1
(Scheduled Completion)
1956 . . . Martins Creek Sta., Unit #2

GRINNELL

WHENEVER PIPING IS INVOLVED

Grinnell Company, Inc., Providence, Rhode Island • Coast-to-Coast Network of Branch Warehouses and Distributors

pipe and tube fittings • welding fittings • engineered pipe hangers and supports • Thermolier unit heaters • valves
Grinnell-Saunders diaphragm valves • pipe • prefabricated piping • plumbing and heating specialties • water works supplies
industrial supplies • Grinnell automatic sprinkler fire protection systems • Amco air conditioning systems

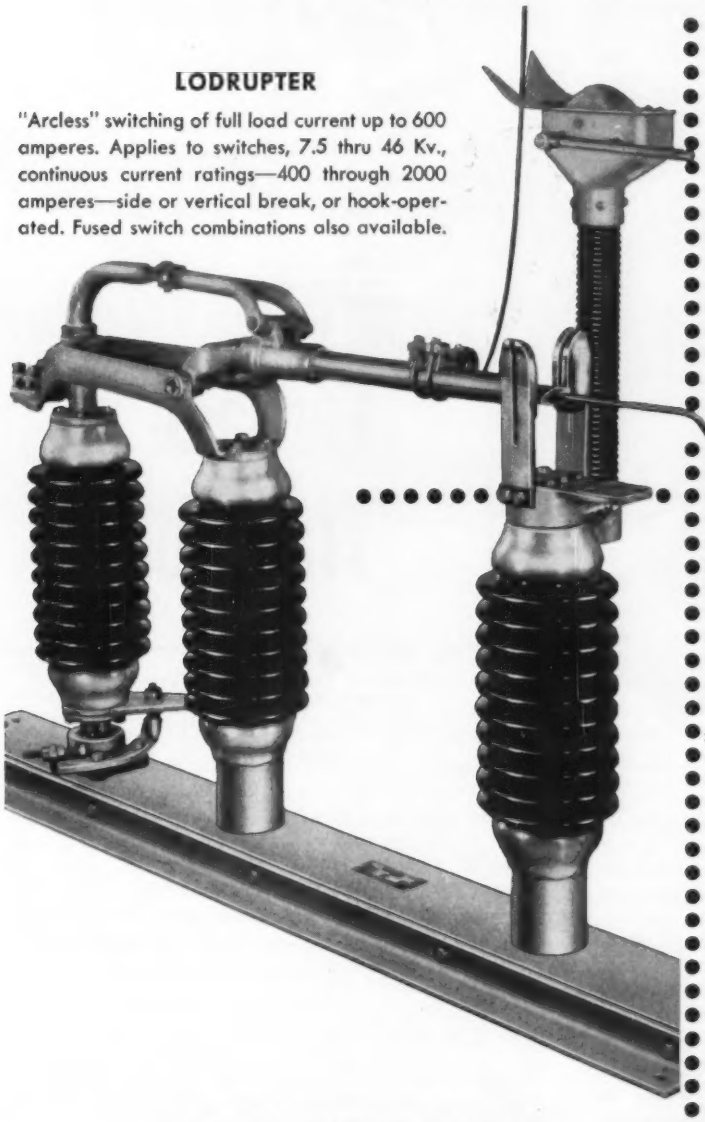
R&IE AIR SWITCHES

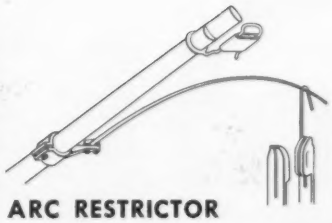
now have increased usefulness with the development of

INTERRUPTER ATTACHMENTS

LODRUPTER

"Arcless" switching of full load current up to 600 amperes. Applies to switches, 7.5 thru 46 Kv., continuous current ratings—400 through 2000 amperes—side or vertical break, or hook-operated. Fused switch combinations also available.

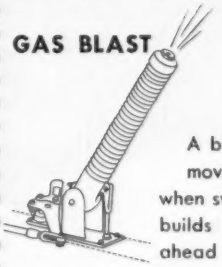




ARC RESTRICTOR

High Speed horns to interrupt line charging current of 15 amps., transformer magnetizing current up to 100,000 Kva. Applies to switches rated up to 138 Kv. Furnished with new switches, or can be attached to already installed switches.

GAS BLAST

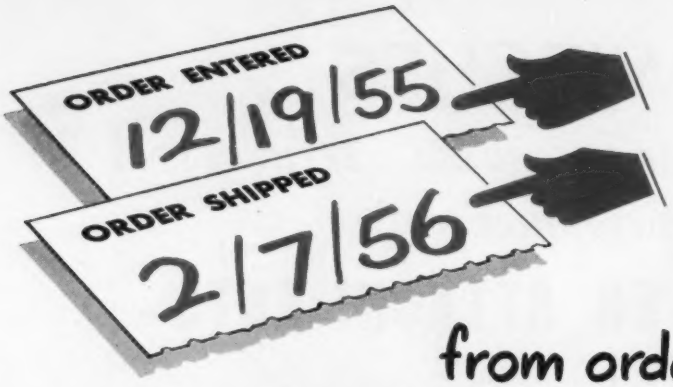


A blast of air or nitrogen moving into the path of arc when switch opens (or closes) builds up dielectric strength ahead of restored voltage. Interrupts line charging current or transformer magnetizing current—200 amperes at 34.5 Kv,—to 20 amperes at 330 Kv.

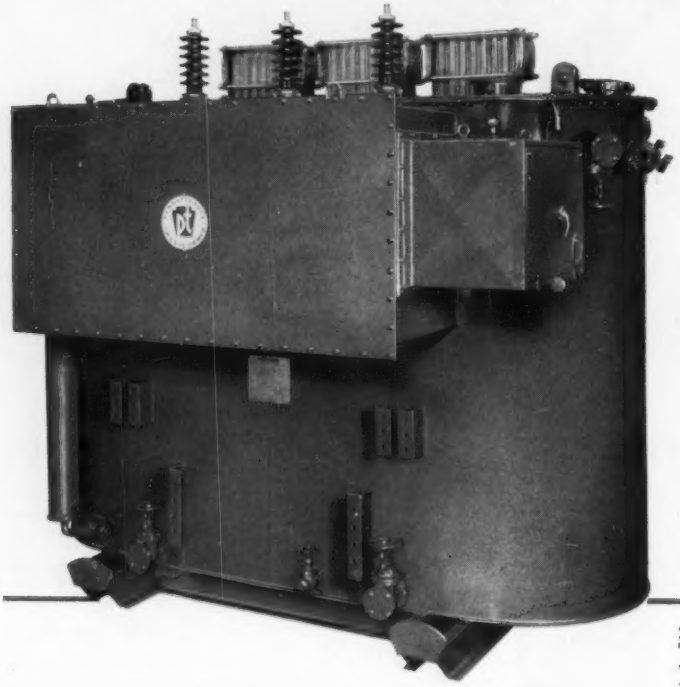
The R&IE scope of interrupting devices has expanded to the area of complete application for definite system switching economies. Complete data and interrupting rating tabulation is available on any of the devices shown. Ask to see the test films or actual operation of any of them.

R&IE EQUIPMENT DIVISION
I-T-E CIRCUIT BREAKER CO.
GREENSBURG, PENNSYLVANIA

R&IE



Only 50 days from order to shipment!



20,000 kva Pennsylvania Furnace Transformer

20,000-kva Pennsylvania Furnace Transformer. Three phase, 60 cycles, water-cooled. High voltage: 24,000 volts. Low voltage: 375 to 250 volts.

The order was entered on Monday, December 19, 1955. 50 days later, on Tuesday, February 7, the finished transformer was loaded on a railroad car and sent on its way to the customer. Like most other furnace transformers, this one was custom-designed and custom-built to meet limiting dimensions. Accessories and auxiliary equipment had to be located on the high voltage side and ends of the tank. Low voltage bus work had to match existing facilities.

A 50-calendar-day delivery for a 20,000-kva furnace transformer is not an everyday requirement at Pennsylvania, but when circumstances demand it, deliveries such as this can be made.

Sixteen years ago, in 1940, Pennsylvania was called upon to design and deliver a 15,000-kva, 3-phase, 25-cycle furnace transformer in record time. A large transformer by today's standards, it was even more so a decade-and-a-half ago. Pennsylvania designed, built, and shipped that transformer in 35 calendar days and it is in active service today in a large steel mill.

Which all boils down to this:

If you have a furnace transformer problem — whether it involves short-time delivery, special requirements, or unusual design problems — it will pay you to consult Pennsylvania.

PENNSYLVANIA TRANSFORMER COMPANY
A McGraw Electric Company Division CANONSBURG, PA. Greater Pittsburgh District

Photo courtesy R. G. LeTourneau, Inc., Longview, Texas

Lifeguard for landing craft

This Landing Craft Retriever promises to save the Army Transportation Corps millions of dollars.

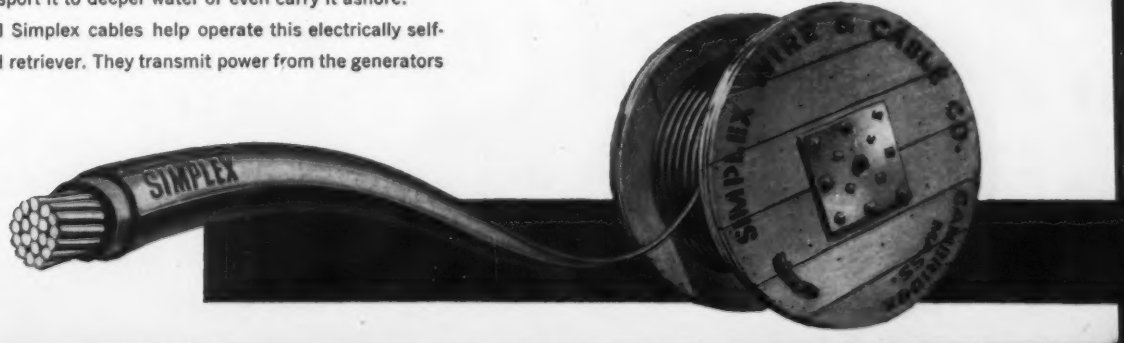
In World War II landings, enemy action accounted for only 10 per cent of the landing craft knocked out of service. The majority were sunk or grounded by rough seas, but could have been used again if there had been a fast, economical way to refloat them.

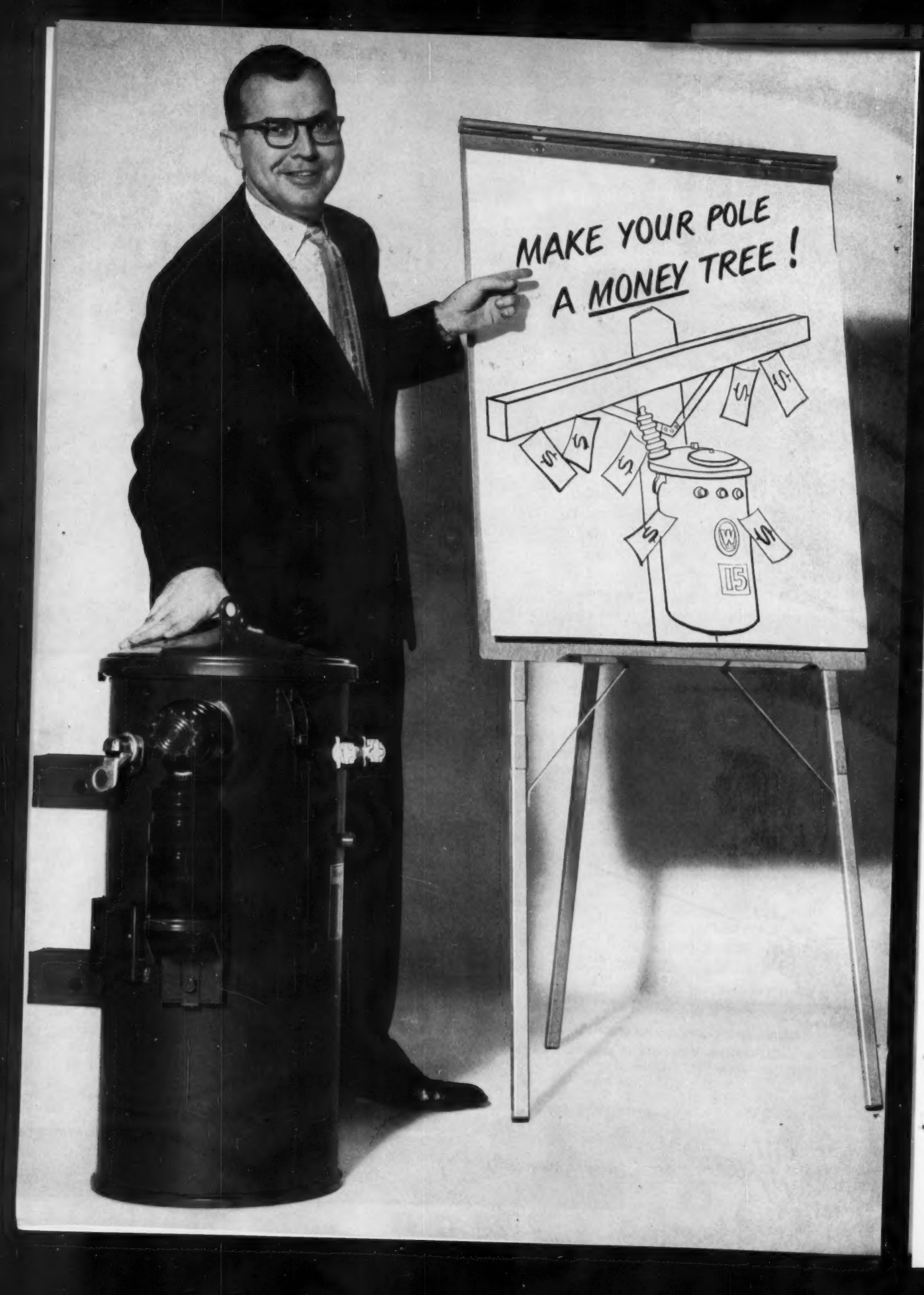
The Landing Craft Retriever developed by R. G. LeTourneau, Inc. is a practical answer to this giant salvage problem. Capable of straddling a 67-ton vessel, it can "right" the craft and transport it to deeper water or even carry it ashore.

Special Simplex cables help operate this electrically self-propelled retriever. They transmit power from the generators down to the four 10-ft. wheels, each of which has a separate built-in motor and gear reduction unit.

Simplex was chosen to make these vital cables because of its recognized ability to produce dependable cables and cords for specific needs.

Contact your Simplex representative about your problem today. Chances are, he can supply you with a standard or special cable that satisfies all your requirements. **SIMPLEX WIRE & CABLE CO.,** 79 Sidney Street, Cambridge 39, Mass.




MAKE YOUR POLE
A MONEY TREE !
W
15

Increase transformer overload capacity 20%

. . . without sacrifice of service life

Bold pioneering with a new system of Life-Testing now reveals how much heat modern Westinghouse transformers can take—and still deliver continuous service. Applied to the 1956 line of Westinghouse distribution transformers, it means simply this —greater, longer overloads, *without sacrifice of normal service life.* In addition, it offers a welcome reduction in costly emergency service calls.

NEW "CSP®" TRANSFORMERS—Higher breaker settings boost overload capacity an average of 20%. Drastically reduced breaker trip-outs, greater flexibility in timing of change-outs . . . all this is available in the new Westinghouse "CSP" transformers because breaker settings have been stepped up to take advantage of the extended safe range. These new settings are based on 18 months of laboratory life-testing, backed up by as much as three years of field experience by three utilities.

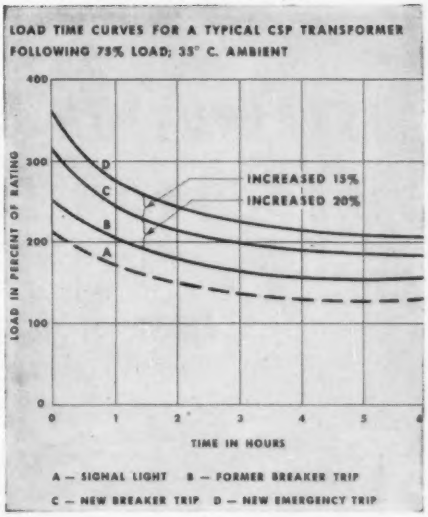
NEW CONVENTIONAL TRANSFORMERS—Available with new TD indicator to take guesswork out of loading. All the advantages proved by Functional Life-Testing are offered in conventional transformers, and in addition:

Now, for the first time, they can be loaded for peak efficiency. Because the new TD indicator keeps an accurate and permanent record of overload hours, the two extremes of burnouts in some locations with wasted capacity in others can easily be avoided. This is an effective tool for load management.

The combined effect of newly proved thermal endurance and the efficiency of loading substantially increases conventional transformer economy.

For further information on the all-new lines of distribution transformers, call your nearest Westinghouse representative, or write direct to Westinghouse Electric Corporation, P. O. Box 868, 3 Gateway Center, Pittsburgh 30, Pennsylvania. J-70761

◀ Bob Wagner, Manager, Distribution Equipment Sales, dramatically points out that there's more money on the line for utilities using the new Westinghouse distribution transformers.



Higher breaker settings on the new "CSP" transformer give 20% more sustained overload capacity without sacrifice in transformer life, additional 15% emergency range. Signal light remains at standard ASA setting.

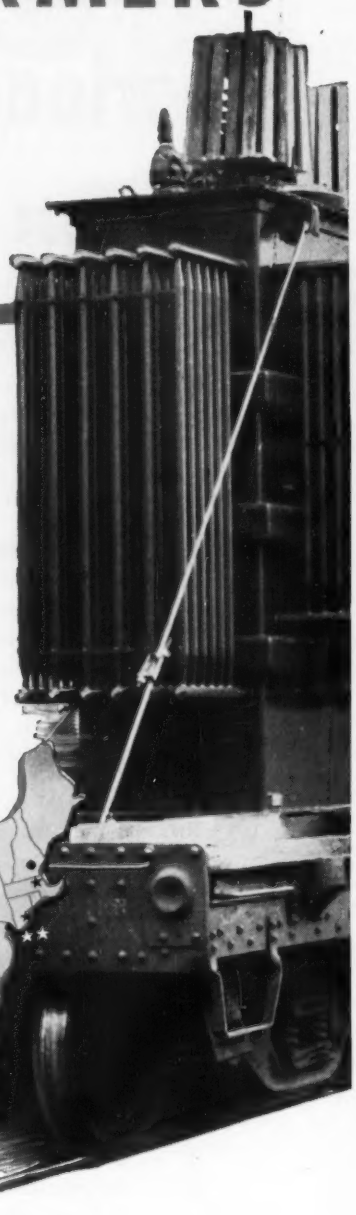
A cumulative overload record. Signal light shows when unit is overloaded on the basis of copper temperature; dial records total hours of overload experienced. Easily read from the ground. Can be reset.

YOU CAN BE SURE...IF IT'S

Westinghouse

POWER TRANSFORMERS

. . . Another carload shipment of Kuhlman power transformers on its way! New Kuhlman design features protect them against damage in shipment. Quick Kuhlman service, too, on quotations and handling of your orders.

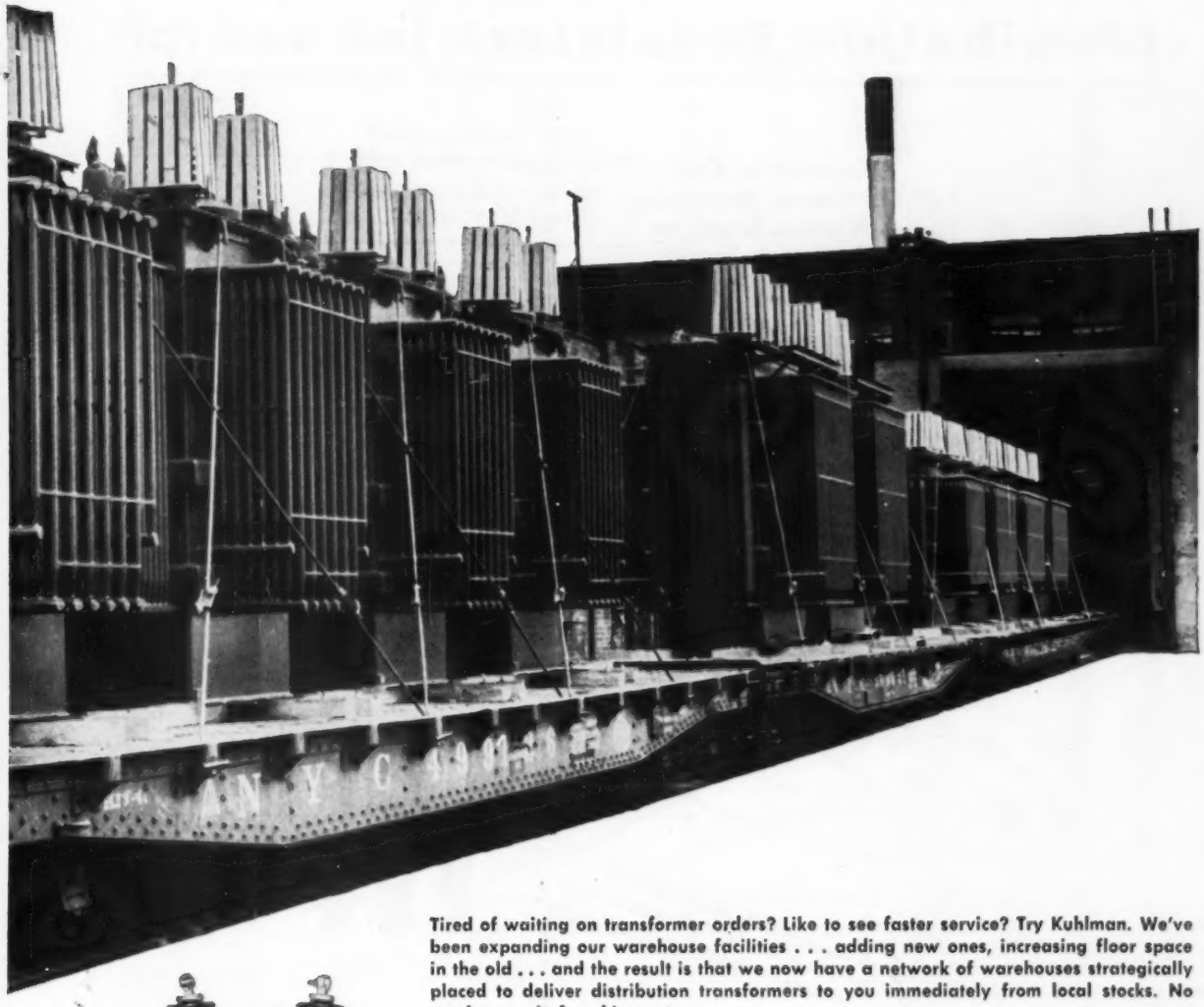


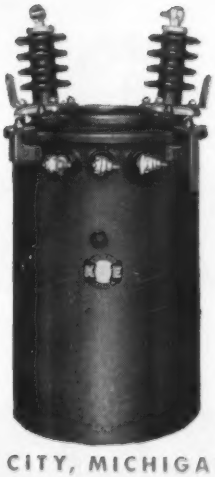
DISTRIBUTION TRANSFORMERS DIRECT FROM LOCAL STOCK!

There is a Kuhlman Sales Office and local stock in your area to serve you!

KUHLMAN ELECTRIC COMPANY

BY THE CARLOAD!





Tired of waiting on transformer orders? Like to see faster service? Try Kuhlman. We've been expanding our warehouse facilities . . . adding new ones, increasing floor space in the old . . . and the result is that we now have a network of warehouses strategically placed to deliver distribution transformers to you immediately from local stocks. No need to wait for shipments.

Another reason you'll like Kuhlman service is that we're small enough to avoid red tape and interdepartmental tie-ups. We're a compact group of specialists. Power transformer orders go into production at once, and our 63 sales offices can call direct to the factory any time a question crops up. We can give you greater attention . . . personal attention. And the same holds true for follow-up. Our sales and factory representatives, all experienced transformer engineers, will assist you in supervising the installation, testing, and putting into operation of your Kuhlman equipment. Factory guaranteed, your installation is backed by Kuhlman's 61 year reputation for quality products and friendly service. These are benefits you get regularly from Kuhlman.

The next time you need transformers, call your Kuhlman representative. We're sure you'll like our more personal service.

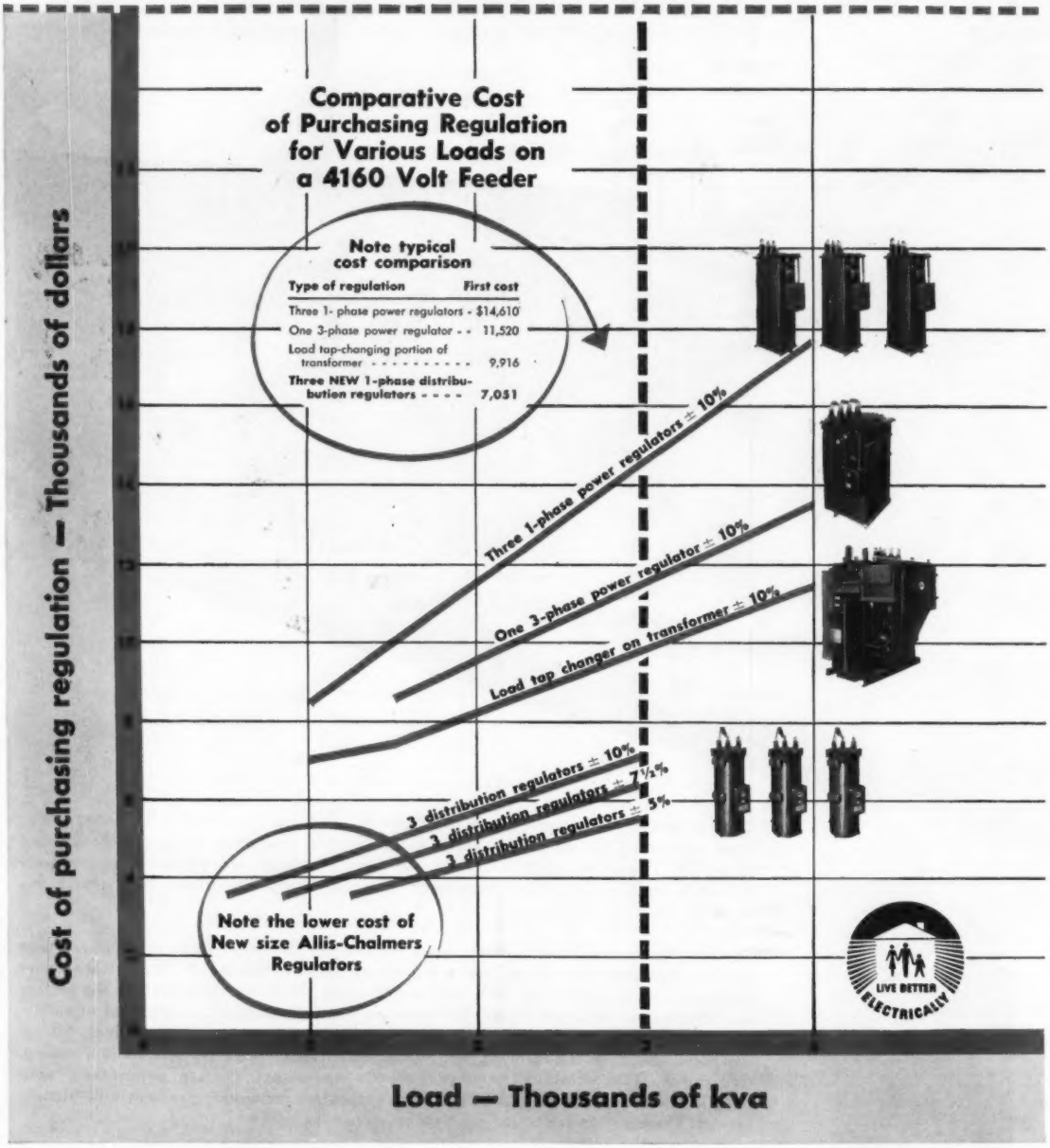
KUHLMAN ELECTRIC

174

BAY CITY, MICHIGAN • CRYSTAL SPRINGS, MISSISSIPPI • SALINAS, CALIFORNIA

Save 24% to 50% with...

Now Larger Units to Distribution Regulators instead of


Comparative Cost of Purchasing Regulation for Various Loads on a 4160 Volt Feeder
Note typical cost comparison
Type of regulation — First cost
Three 1- phase power regulators - $14,610
One 3-phase power regulator - - 11,520
Load tap-changing portion of transformer - - - - - - - - - - 9,916
Three NEW 1-phase distribution regulators - - - - 7,031
Three 1-phase power regulators ± 10%
One 3-phase power regulator ± 10%
Load tap changer on transformer ± 10%
3 distribution regulators ± 10%
3 distribution regulators ± 7½%
3 distribution regulators ± 5%
Note the lower cost of New size Allis-Chalmers Regulators
LIVE BETTER ELECTRICALLY
Cost of purchasing regulation — Thousands of dollars
Load — Thousands of kva

GET INFORMATION

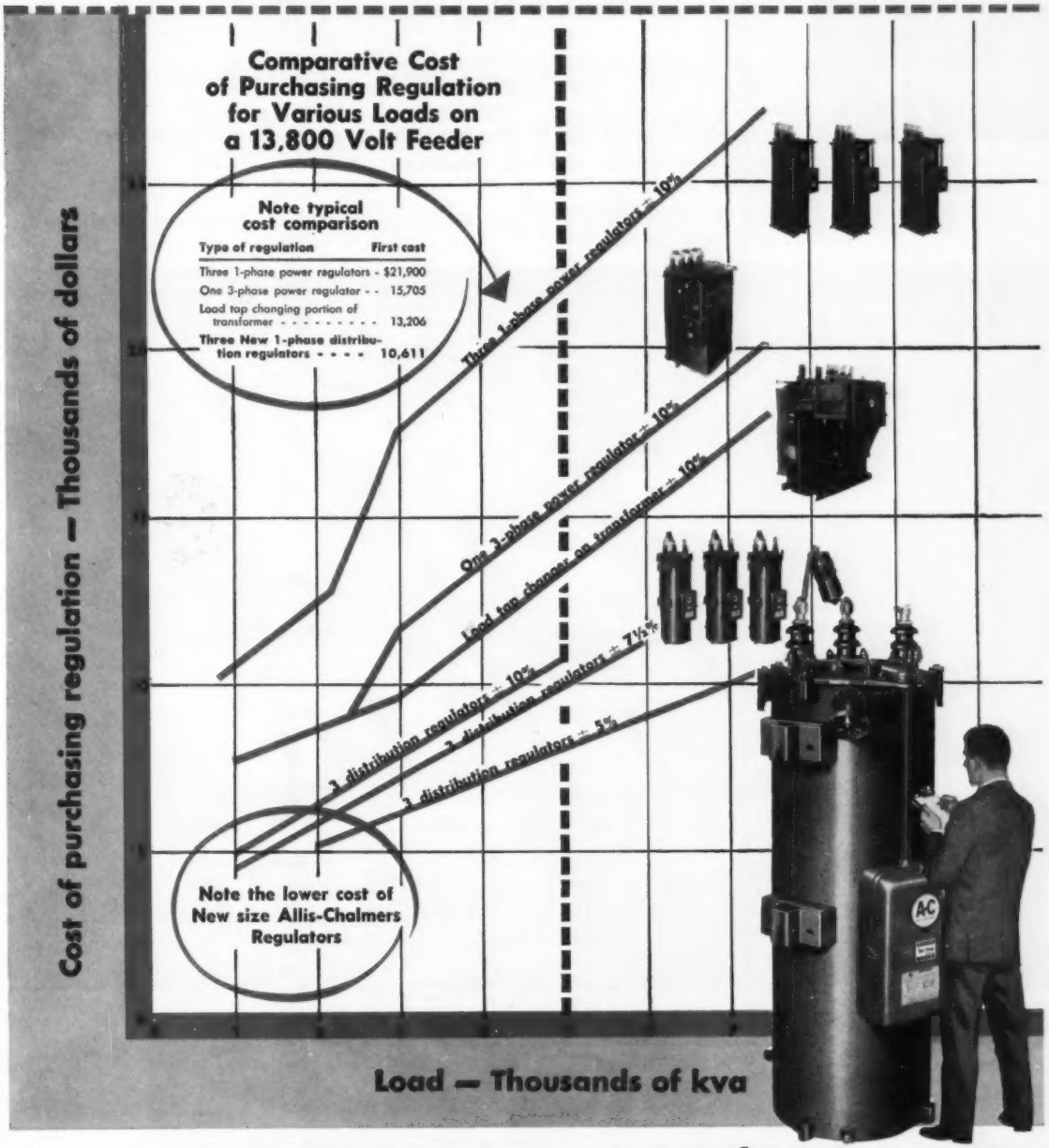
Call your nearest A-C office for complete story, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

A-5041

ALLIS-

...New Regulator Ratings

167 Kva Permit Use of Station Regulators or LTC Transformers


Comparative Cost of Purchasing Regulation for Various Loads on a 13,800 Volt Feeder
Note typical cost comparison
Type of regulation | First cost
Three 1-phase power regulators - $21,900
One 3-phase power regulator - - 15,705
Load tap changing portion of transformer - - - - - - - - - 13,206
Three New 1-phase distribution regulators - - - - 10,611
Three 1-phase power regulators — 10%
One 3-phase power regulator — 10%
Load tap changer on transformer — 10%
3 distribution regulators — 10%
3 distribution regulators — 7½%
3 distribution regulators — 5%
Note the lower cost of New size Allis-Chalmers Regulators
Cost of purchasing regulation — Thousands of dollars
Load — Thousands of kva

Check New Range of Ratings

VOLTS	AMP
14,400	50, 100
7,620	15, 25, 50, 75, 100, 150, 219
5,000	50, 100, 150, 200
2,500	100, 150, 200, 300, 400

CHALMERS

THERE'S A STOREHOUSE OF KNOWLEDGE AT MOLONEY

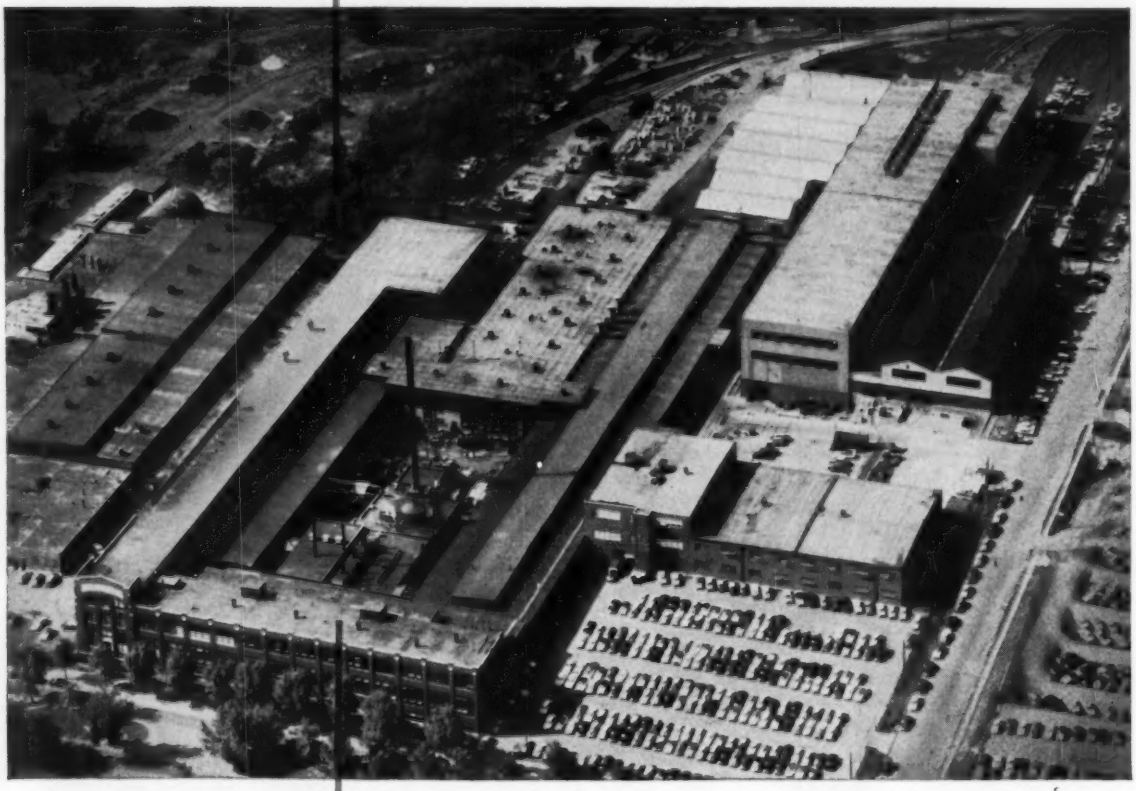
knowledge gleaned from 60 years of experience in manufacturing transformers . . .

knowledge gained from research . . .

knowledge gained from experience by Moloney's engineers . . .

knowledge that helps Moloney design and fabricate dependable transformers . . .

knowledge that means dependability in service and performance . . .



knowledge that benefits you and your utility system.

MES5-30

MOLONEY ELECTRIC COMPANY

Power Transformers • Distribution Transformers • Load Tap Changing Transformers • Regulating Transformers • Step Voltage Regulators • Primary Unit Substations • Secondary Unit Substation Transformers • Network Transformers • Series Street Lighting Transformers • Subway Transformers • Industrial Dry Type Transformers • Capacitors • Magnetic Components for Electronics

SALES OFFICES IN ALL PRINCIPAL CITIES • FACTORIES AT ST. LOUIS 20, MISSOURI AND TORONTO, ONT., CANADA

ELECTRICAL BUSINESS OUTLOOK

Electrical World
APRIL 30, 1956

High money rates will prevail for some time. Increasing capital expenditures by industry (25% over last year) will be a big influence. In just the past six weeks yields on A-rated utility bonds have edged up from 3.35 to over 3.80%. The difference means utilities will find the yearly interest tab about $5 million higher for every $1 billion of A-rated bonds issued.

Electric utiilties had planned to issue around $400 million in mortgage bonds in the second quarter of 1956 reports Irving Trust Co of New York. In the first quarter utilities sold $142 million as against $282 million in the same quarter last year. Chances are actual issues will be somewhat less than $400 million. Postponements are already piling up. Record high interest rates and expected large bond issues by American Telephone & Telegraph and General Electric (AT&T—$250 million, GE—$300 million) will make the bond market considerably less attractive for utilities in this quarter (See p 63).

• • •

Oil looms as the next item to hit the budget. Independent producers are pushing for a 60¢ boost in the present crude oil price of $2.90 per barrel. Producers face higher exploration and production costs as new (and less productive) wells get harder to find. Refiners are pinched by higher wages and soaring price tags on new equipment.

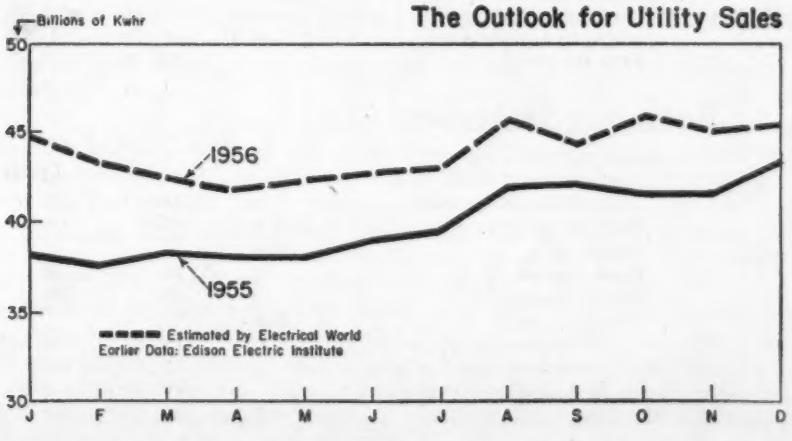
Bunker oil used in power plants could jump a maximum 30¢ per barrel if crude goes up 60¢ according to an industry observer. At this rate utility operating expenses would skyrocket about $21.9 million if oil consumption just held at the 73 million barrels consumed in '55.

• • •

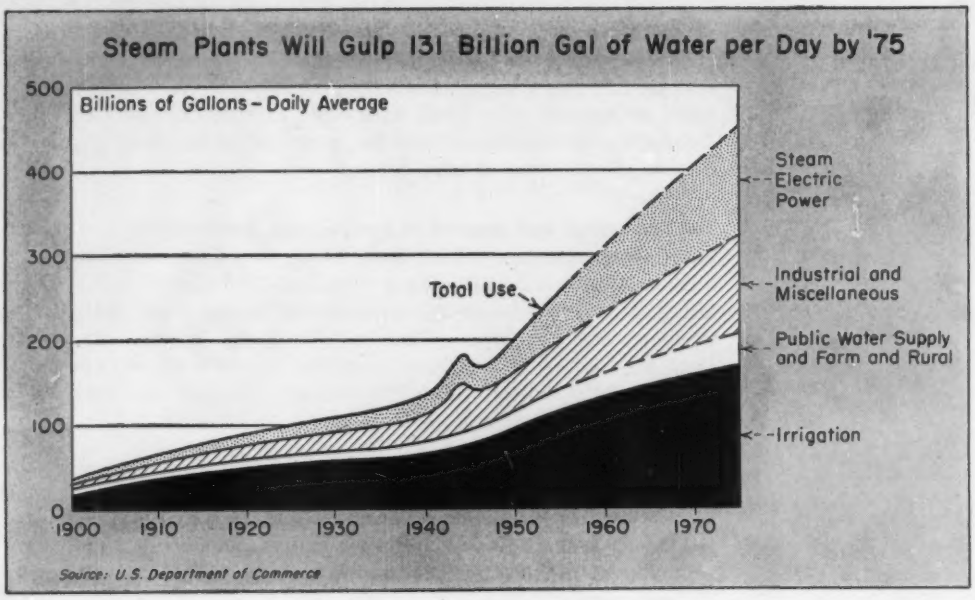
Power consumption will hit 1.5 trillion kwhr by 1966 predicts Ralph J. Cordiner, president of General Electric. Cordiner's prediction means consumption will jump more than 213% over 1955's 479 billion kwhr.

December '56 peak load estimates compiled by FPC have been raised 2.9 million kw above the 102.6 million kw predicted a year ago. The January estimate by the nation's utilities sets this year's peak at 105.5 million kw—7.3% higher than the 98.3 million hit last December.

The Outlook for Utility Sales



STATISTICS



Power Statistics . . .

		Latest Month	Preceding Month	Year Ago	Annual Change %
Capacity	Feb.	115.59	114.55	103.74	11.4
Peak—Class I Systems (million kw)	Jan.	95.8	98.2	84.1	13.9
Estimated Dec. '56 Peak (million kw)	Jan.	105.45	105.27	102.56	2.8
Production—billion kwhr	Feb.	47.99	51.12	40.23	19.3
Hydro		10.63	9.36	8.57	24.0
Fuel		37.36	41.76	31.66	18.0
Sales—billion kwhr	Jan.	46.32	45.19	39.47	17.4
Residential		13.41	12.25	11.76	14.0
Commercial		7.00	6.81	6.24	12.2
Industrial		23.57	23.75	19.31	22.1
Other		2.34	2.39	2.15	8.8
Fuel Consumption	Feb.				
Coal—million tons		13.44	15.22	11.09	21.2
Oil—million barrels		7.10	8.22	7.43	−4.4
Gas—billion cu ft		67.81	68.27	63.63	6.6
Net Income Class A & B Co's—$ million	Jan.	127.26	125.72	112.21	13.4
Residential Customers—millions	12 mos.	44.51	44.41	43.24	2.9
Revenue per kwhr	ended	2.64¢	2.65¢	2.69¢	−1.9
Avg kwhr per customer	Jan. 31	2,778	2,751	2,564	8.3
Avg annual bill		$73.34	$72.63	$68.97	6.3

Business Statistics . . .

Indexes: 1947—49 = 100					
FRB Industrial Production	Mar.	145	144	138	5.1
ENR Construction Cost	April	143.2	142.8	135.7	5.5
BLS Cost-of-living	Feb.	114.6	114.6	114.3	0.3
NEMA Sales	Feb.				
Insulation materials		163	159	137	19.0
Electric appliances		109	105	107	1.9
Wholesale prices	Feb.				
Motors and generators		126.6	126.5	121.0	4.6
Transformers and regulators		131.2	131.2	127.8	2.7
Switchgear and fuses		147.5	147.5	135.4	8.9
GNP—annual rate—$ billion	4th Qtr.	397.3	392.0	367.1	8.2

Your Business

The champagne people tell us not to be afraid to serve the bubbly liquid when we celebrate a wedding anniversary, entertain the boss, or just throw a party. They offer these tips on champagne etiquette:

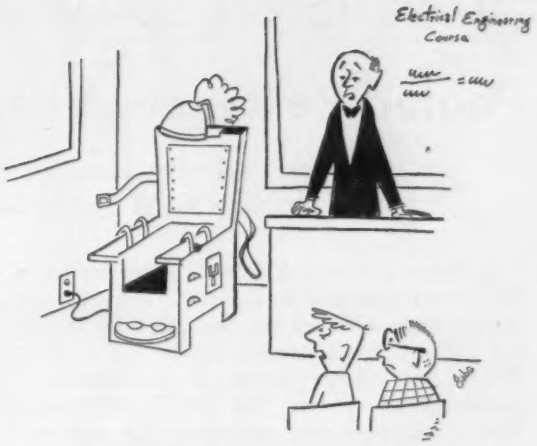
Know the difference between "vintage" and "non-vintage." Vintage is one in which all the wine is of a particular year (marked on the bottle). Non-vintage is a blend of the production of various years. Non-vintage champagnes cost less, and many are considered excellent by connoisseurs.

Store your champagne some place that's dark and cool. Three hours before serving, place bottle in your refrigerator—away from the freezing compartment. To keep cork moist and the champagne fresh, always store the bottle on its side, never upright.

There's an art to opening a bottle of champagne. Trick is to have just enough pop to keep the event exciting but not to make it so explosive as to cause the wine to lose effervescence. Secret lies in twisting the bottle away from cork. Do not twist cork.

When serving pour slowly, filling each glass only half way. That way the wine won't become stale or warm before it's drunk. It is not considered right to cover the bottle with a towel when serving.

A split of French champagne is 6 ounces; a "quart" holds 26, a magnum 52, and a Jeroboam 104. Other sizes, not available in the U. S., have such biblical names as Rehoboam, Methusalah, Salamazar, Balthazar, and, Nebuchadnezzar (4 gals).



". . . Now, for today's experiment in electricity . . ."

Booklets available for company reading rack, or your personal pleasure: "How to Carry Pressure," by Melvin J. Evans, 25¢ each, less for bulk orders from Democracy In Action, Inc, 1038 Sterling Drive, Flossmoor, Ill; "Fathers of Industries" series, brief biographies of industrial pioneers, from Mercer Publishing Co, 16 East 52nd St, New York 22, N. Y., at 15¢ each, less for bulk orders.

The cartoon on this page brings to mind the story of an emperor who used an electric chair as a throne. At the turn of the century, Emperor Menelek II of Ethiopia became intrigued with the possibilities of the hot seat and ordered two from this country. Amazed to find they required electricity, which was unavailable in his land, he compromised by using one as his throne for years.

Your Health

REX H. WILSON, MD, Medical Director, B. F. Goodrich Co

People are eating themselves into illnesses. If they would only realize this, they would not overeat. Fat people die younger. Many diseases are made worse for the individual who is overweight. The sheer bulk of an obese person can twist and deform the skeleton and weaken the body tissues. Ruptures, spinal deformities, postural defects, and impaired circulation can be due to excessive fat. Be smart and "slim down."

The treatment for obesity is to reduce the daily caloric intake until the "ideal weight" is reached. Then a diet containing sufficient calories to maintain the "ideal weight" should be followed. In general, a high protein, low fat, low carbohydrate diet containing 800 to 1,200 calories per day is necessary to lose weight. You should have your physician prescribe a diet that is tailor-made to fit you. The diet should contain palatable food and be satisfying. Lean meat—especially beef—boiled or poached eggs, most vegetables, and most fruits can be included. You will have to give up between-meal snacks, cream, sugar, butter, potatoes, and pastries. You may need additional vitamins and minerals.

Your physician may, if you are the type that "just must eat," prescribe a non-caloric substance that creates bulk in the stomach. He may also prescribe medication to reduce your appetite.

To protect your health and increase the length of your life, get down to your "ideal weight" and stay there. You will be rewarded by your friends telling you how well you look. And just think how proud you will be to know you have "will power."

WASHINGTON COMMENT

Pooled Resources Vital to Atom Power Growth

Opposition to excluding company pools for nuclear power development from Holding Company Act is seen as unrealistic and out of step with the times

A Senate Interstate Commerce subcommittee is considering legislation to prevent a new industrial activity from becoming shackled by restrictions of the Public Utility Holding Company Act of 1935, that is, the industry devoted to development of atomic electric power. The bill (S2643) would exempt from regulation companies which pool their financial resources to build these expensive developmental nuclear plants. The law now reads that operating companies that jointly create another operating company must register with the Securities and Exchange Commission. The proposed legislation would exempt nuclear development enterprises. It would not exempt companies otherwise required to register under the act.

Curiously, one of the chief objectors of the bill is SEC Chairman J. Sinclair Armstrong. He says that the proposal would grant "broad, automatic, and permanent exemptions from the act without regard to all the circumstances of each particular case."

The validity of this argument is open to question. In the first place, regulatory statutes are passed ex post facto. That is, they are brought into being after some industry has come under public scrutiny, and Congress subsequently decides to regulate it. Regulation seldom is voted before hand. Certainly this is the circumstance in which the embryonic atomic power industry is found today—It shows no signs of becoming a "bad citizen" which needs regulation.

Yet, Armstrong argues that pool-owned atomic power companies should be regulated. Perhaps he feels they will become too powerful.

But there are these factors to consider:

1. Cost of nuclear plants puts projects beyond the reach of most utilities—to be economical. They must compete with modern steam plants, and nothing less than 100,000-kw stations can provide low-cost power. These facilities run about $20 million. Since more than half of 185 independent electric utility companies recently surveyed have plant accounts of less than $50 million, according to one witness at the hearings, it can easily be seen that the number of firms able to pick up the tab for a nuclear reactor without help is small. Thus, pool arrangements seem the only way to get the job done.

2. The framers of the Holding Company Act could not have known in 1935 that a new energy source would necessitate the pooling of company resources to overcome heavy initial costs. It seems reasonable to believe that, had they known, they would have considered exemptions for today's experimental reactor projects.

3. Last is the fact that the abuses which led to the act have been eliminated.

Enactment of the pending bill would be the first amendment of the Holding Company Act since its passage.

TECHNICAL NOTES

Flyash is not a cement, but it has excellent pozzolanic action and unites with lime to form a very hard and durable cementitious material.

Mobile circuit breakers mounted on self-propelled trucks reflect a trend among European utilities to eliminate disconnect switches.

Temperature effects on conductor resistance are sometimes easier analyzed in deg K because all metals approach zero resistance at 0 in that scale. This puts resistance on the same temperature basis as dissipation of heat by radiation.

Sand from the ocean can carry enough salt into a concrete mix to rust steel reinforcements.

Corn-cob dust blown by 60-psi air dry cleans hydrogenerators at about 40% of the cost of manual methods. Precautions include filtering moisture from air supply and sealing journal housings and oil wells.

Rockets can lay pulling cord accurately across ravines to be spanned and over energized lines to be crossed by new open-wire circuits.

Rate of system load growth has little effect on economic choice of generator rating for usual growth rates.

A deep water table usually makes for more satisfactory conditions for releasing radioactive wastes to the ground.

H&L

PIONEER MANUFACTURER of

Teeth that really dig

heavy duty AUGER HELIX

with replaceable points and fish tail

FORGED STEEL AUGER HEADS FOR ALL MAKES OF AUGER HELIXES

H&L **TOOTH COMPANY**

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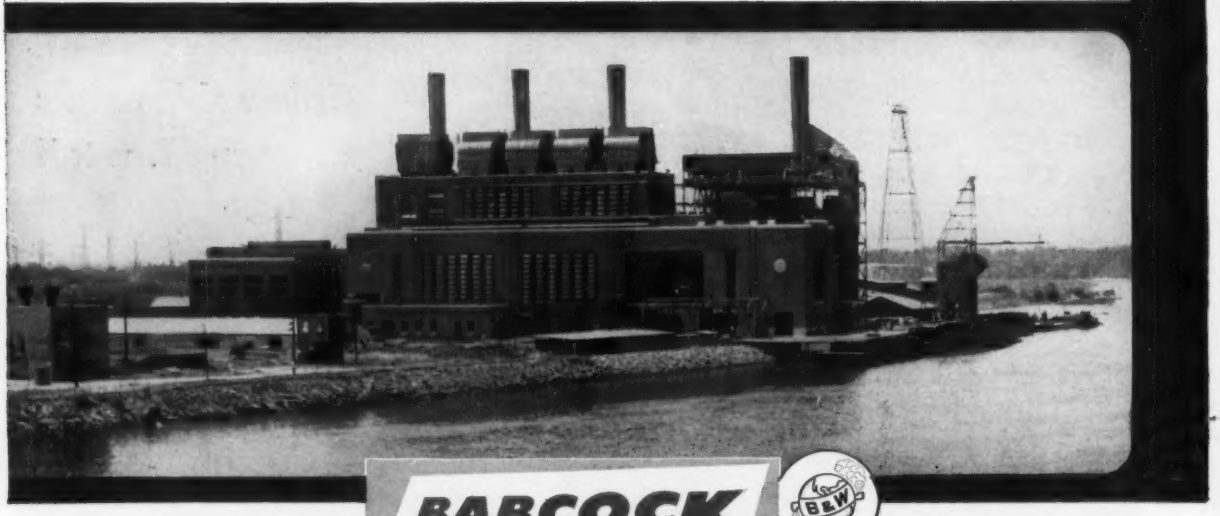
25th *Silver Anniversary*

Modern Central Stations Serving America

NEW B&W RADIANT BOILER FOR

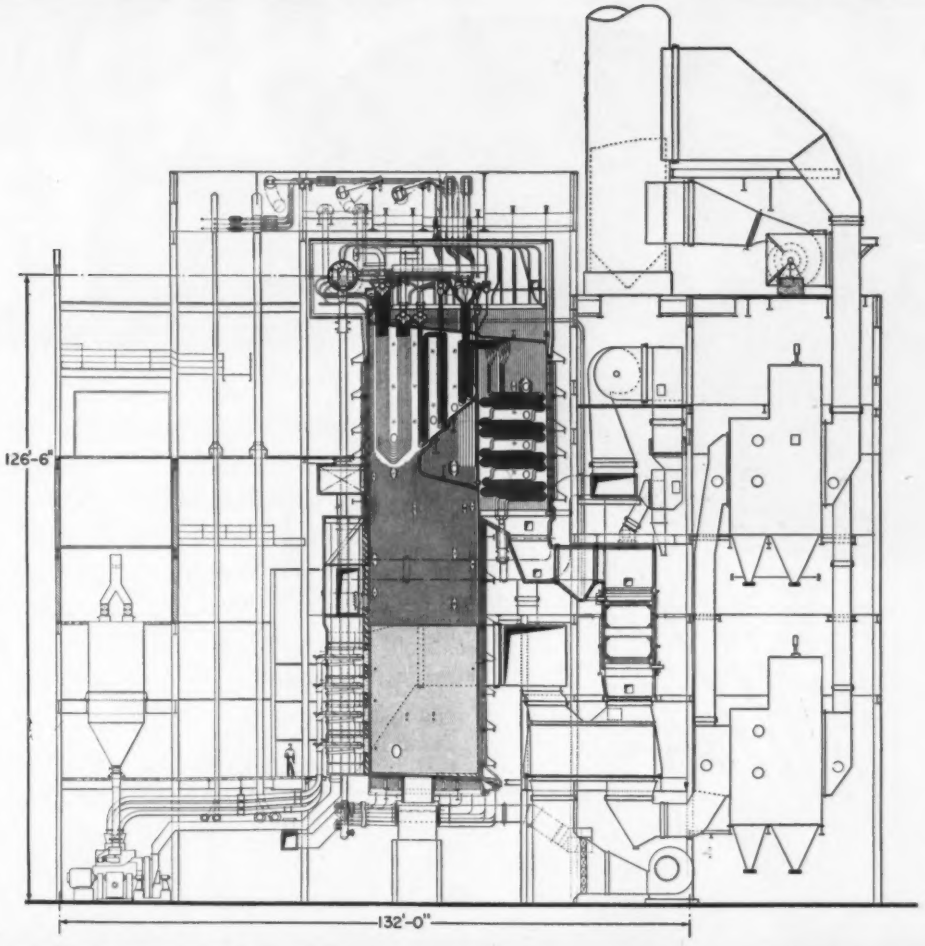
BURLINGTON GENERATING STATION

OF PUBLIC SERVICE ELECTRIC AND GAS COMPANY



BABCOCK & WILCOX

BOILER DIVISION



Supported by sound, practical engineering, Public Service Electric and Gas Company is engaged in a continuing, progressive policy of planning and over-all expansion to provide abundant, economical electricity to its large body of customers.

As part of this far-sighted program, Public Service Electric and Gas Company has installed a new, highly efficient 185,000 KW unit at its Burlington Generating Station. A B&W Radiant Boiler, generating over 1,225,000 pounds of steam per hour, contributes to the high level of performance of this new installation. The boiler is pulverized-coal-fired with provision for oil-firing, and is served by five B&W pulverizers. It is designed with divided furnace construction, gas recirculation, pressure firing and natural circulation. Unit design pressure is high—2700 psi, and the temperature is 1100 F at the superheater outlet with reheat to 1050 F.

Modern, efficient B&W steam generators, such as the latest unit at Burlington, are the results of long experience in designing, fabricating, erecting and servicing central station boilers of all types. Reinforcing this experience is an unending program of B&W research and development aimed intensively toward achieving still higher efficiency levels in the future.

The Babcock & Wilcox Company, Boiler Division, 161 East 42nd Street, New York 17, N. Y. G-753

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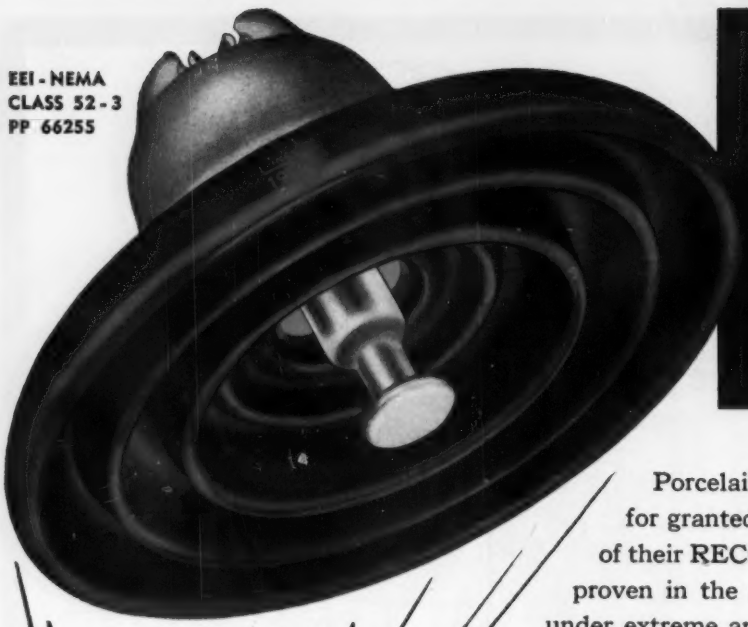
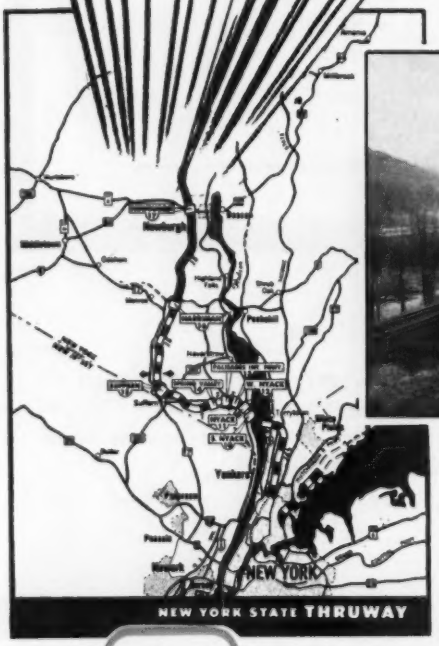
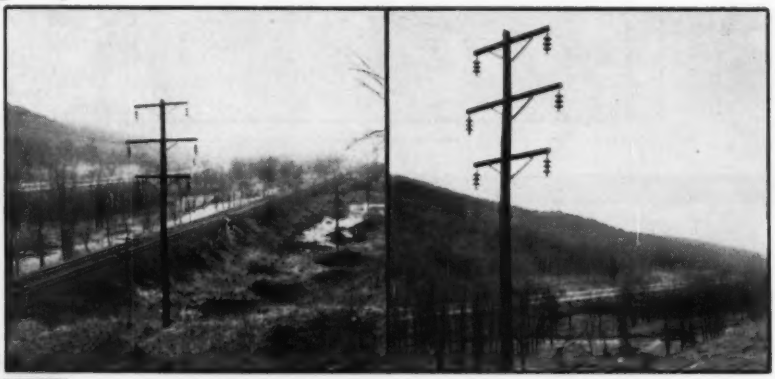


R R

Porcelain Products insulators are taken for granted — taken for granted because of their RECOGNIZED RELIABILITY — proven in the field for more than 63 years, under extreme and exacting conditions.

RECOGNIZED RELIABILITY is acknowledged by the continued widespread and increasing use of Porcelain Products Insulators — a product has to be good to achieve this distinction.





The New York Thruway, a real super, was built through the heart of the ROCKLAND LIGHT & POWER and the ORANGE & ROCKLAND ELECTRIC COMPANY power systems in the vicinity of Nyack, N. Y., precipitating major expansion and relocation problems of their power systems.

The Nyack area, now but 20 minutes from downtown N. Y. is realizing a tremendous program of industrial and residential development—placing enormous new demands on the power systems. Thousands of Porcelain Products Insulators are being used on this transmission expansion and relocation project—used because of their RECOGNIZED RELIABILITY.

PP INC.

Porcelain Products, Inc.

High Voltage Division
Parkersburg, W. Va.

MORE POWER to run the appliances homeowners want—and more kwhr sales—are assured by Silvaline Type SE Service Entrance Cables.

The cable that helps to break a bottleneck

Silvaline is the only Type SE Cable with URC saturant and finish.

IF YOU are encouraging or promoting adequate residential wiring in your area, you'll want to investigate Anaconda's new Silvaline* Type SE Service Entrance Cables for pole to meter installations.

Silvaline Cables with 100-Amp rating, or more, offer equal or greater capacity than called for by the new Voluntary Adequate Wiring Code of the National Association of Home Builders—break the bottleneck to higher kwhr sales. In addition . . .

Long life under severe conditions. Silvaline is the only service entrance cable with URC† saturant and finish. Resists festooning . . . assures long life.

Fewer complaints. Silver finish on Silvaline takes any type or color of house paint . . . won't bleed through, flake or peel. Ends customer complaints.

Ask the Man from Anaconda for more information or write for folder on Silvaline Type SE Service Cables. Address: Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y.

*Reg. U.S. Pat. Off.
†Utilities Research Commission

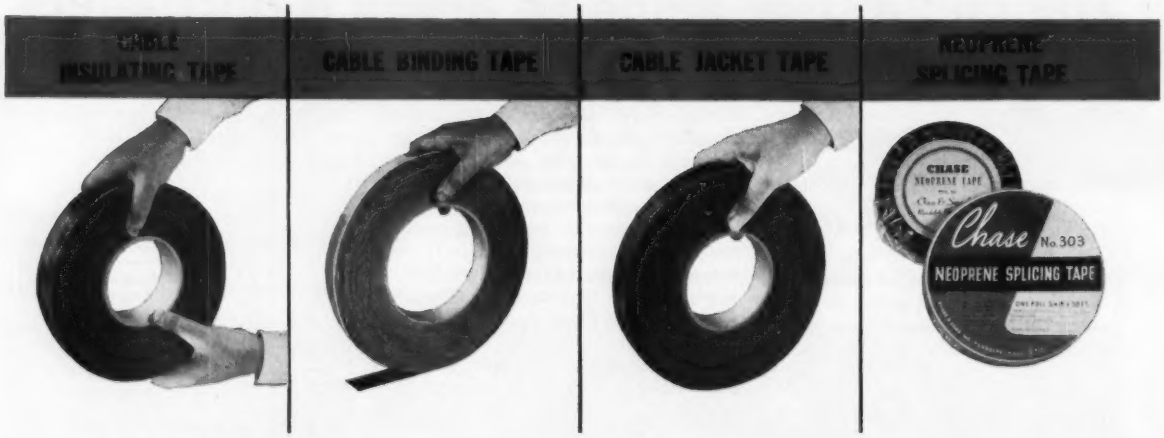
SILVALINE TYPE SE CABLES — 100-AMP RATING OR MORE

Conductors	Insulation	Rating (in amps)
3/C #3 with #3 or #5 neutral	Type RH	100
3/C #2 with #2 or #4 neutral	Type RH	115
3/C #1 with #1/0 or #2 neutral	Type RH	130
3/C #0 with #1 or #3 neutral	Type RH	150

ASK THE MAN FROM ANACONDA®
FOR SILVALINE TYPE SE-100 SERVICE ENTRANCE CABLE

Specify CHASE for superior INSULATING MATERIALS

CHASE WIRE AND CABLE INSULATING TAPES	TYPE OF APPLICATION
1. **COTTON BACKED TAPES** — Coated and filled with: Rubber, GRS, butyl rubber, neoprene and polyvinyl chloride. Single faced and double faced. Thickness — .006" to .060"	Binding, curing and insulating
2. **GLASS FABRIC TAPES** — Coated and filled with: Rubber, GRS, butyl rubber, neoprene and polyvinyl chloride. Single faced and double faced. Thickness — .004" to .060"	Insulating and neoprene jacket
3. **UNSUPPORTED TAPES** — Vulcanized or unvulcanized rubber, GRS, butyl rubber and neoprene. Thickness — .010" to .060"	Insulating, neoprene jacket and polarity
4. **THERMOPLASTIC TAPES** — Unsupported polyethylene and polyvinyl chloride films. Thickness — .002" to .030"	Insulating and binding
5. **SEMI-CONDUCTING TAPES** — Neoprene, butyl rubber, polyethylene. Thickness — (Cotton Backed) .007" to .015" (Unsupported Vulcanized) .012" to .030" (Polyvinyl) .008" to .020"	Conductivity, ozone resistance and binding
6. **YARN REINFORCED TAPES** — Rubber coated, paper backed. Neoprene coated, paper backed. Cellophane and paper sandwich construction. Paper and paper sandwich construction. Asbestos sheet, single and sandwich construction. Thickness — .004" to .020"	Moisture seal barrier, binder and flame retardant binder
7. **SILICONE TAPES** — Silicone rubber coated glass fabric.	High dielectric
8. **LAMINATED TAPES** — Dupont Mylar®, polyethylene, rubber, cellophane, paper.	Binding, insulating



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offers ...VARIETY
...VERSATILITY
...QUALITY STABILITY

in ELECTRICAL INSULATING MATERIALS

VARIETY — The wide variety of insulating materials which CHASE offers the Electrical Industry is evident in the list at left. This list is flexible . . . and we will be glad to augment it with a tape designed to *your* specifications. Let us help you meet your particular wire or cable insulating requirements.

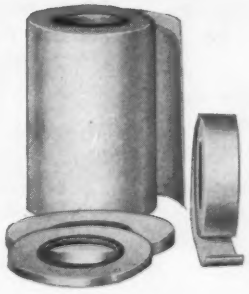
VERSATILITY — Many of these tapes are multi-purpose in application and can be easily adapted to new uses. Constant research and exclusive manufacturing techniques provide the perfect combination of high insulation strength and long life . . . in cotton, glass, synthetic fabrics or unsupported plastics, rubber, neoprene butyl or polyethylene constructions.

QUALITY STABILITY — All CHASE products are engineered by specialists in this field . . . and must meet the highest of specifications . . . using only the best materials available. Join the numerous original equipment manufacturers and large wire and cable plant operators who specify CHASE to be assured of consistently high quality.

For complete data on the Chase products which interest you, simply check the coupon, attach to your letterhead, and send to CHASE & SONS, INC., RANDOLPH, MASS.

FRICTION, RUBBER & PLASTIC TAPE

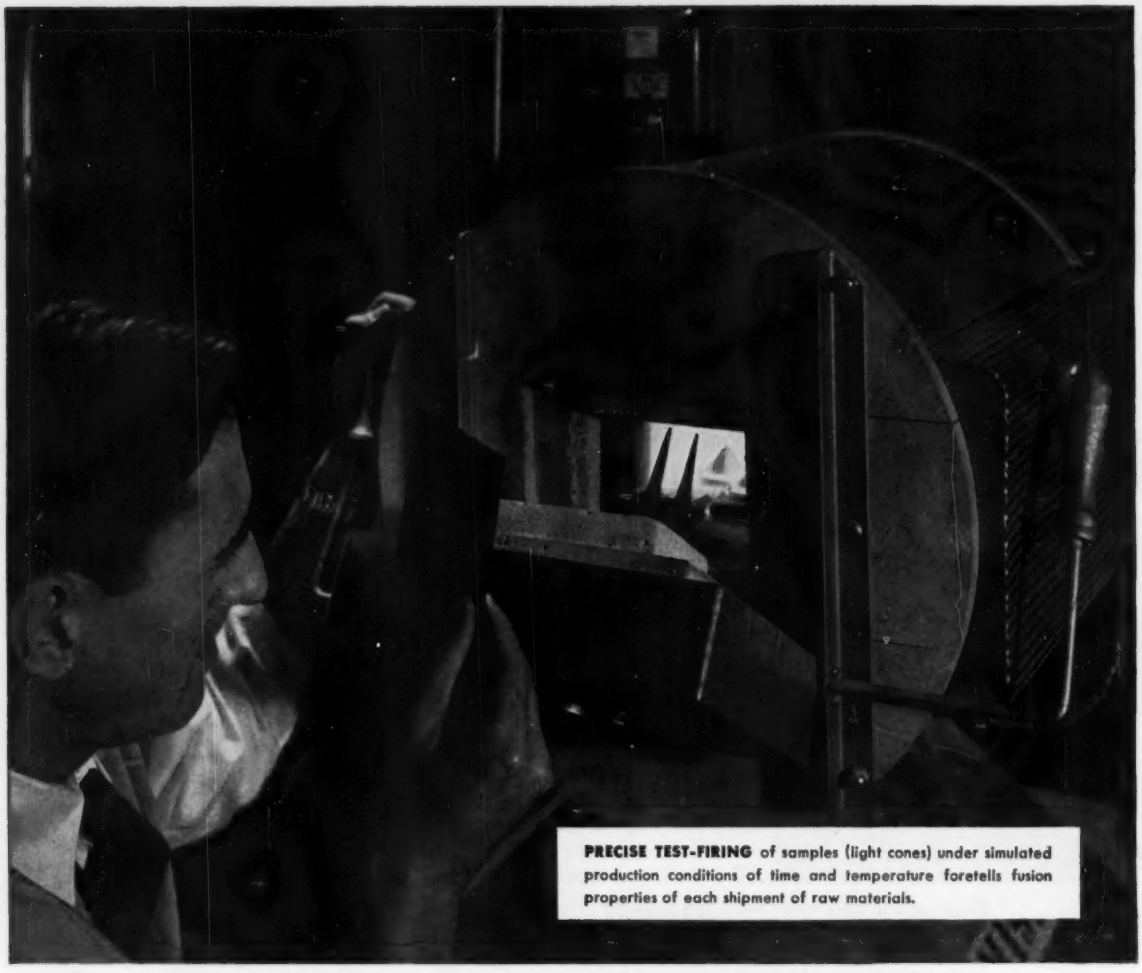
LAMINATED & REINFORCED INSULATION



CLIP AND ATTACH TO YOUR LETTERHEAD

Please send more information on the items checked below:

- ☐ Class "B" Insulation
- ☐ Class "H" Insulation
- ☐ Slot Insulation
- ☐ Cable Insulating Tape
- ☐ Cable Binder Tape
- ☐ Cable Jacket Tape
- ☐ Neoprene Splicing Tape
- ☐ Friction, Rubber & Plastic Tape



PRECISE TEST-FIRING of samples (light cones) under simulated production conditions of time and temperature foretells fusion properties of each shipment of raw materials.

How good can an insulator be? CONSIDER THE EFFECT OF RAW

The *quality* of raw materials used in the manufacture of porcelain suspension insulators has a direct bearing on insulator performance.

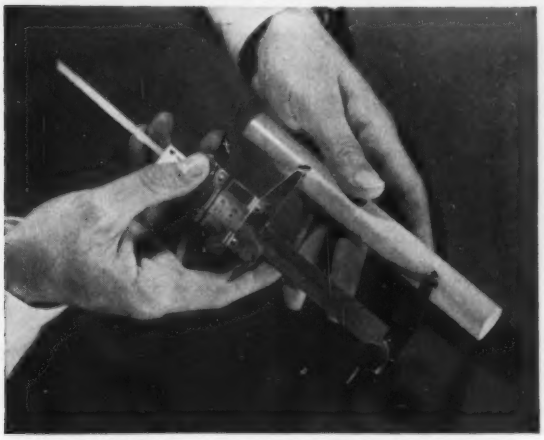
Only a slight variation from standards in the chemical composition of clay, in the vitrifying characteristics of feldspar, or in the purity of flint can result in loss of insulator strength.

To protect you against the possibility of insulators made of inferior raw materials, Locke subjects flint, feldspar and clay to 14 different quality control tests... *before shipments even enter our plant.* This prevents trouble before it starts!

The case of Locke Raw Material "Quality Control" is typical of the extremes to which Locke goes to assure trouble-free insulator service on your system.

DROP BY DROP, an analyst determines the exact proportions of silica and oxides of aluminum, sodium, potassium as well as other elements in clays and feldspar. Results are used as a production guide to assure uniformity.

FINENESS OF FLINT and feldspars is accurately determined by a screen test and compared with standards before a shipment is accepted. This physical property has direct effects on firing characteristics of these materials.



AS CLAY SHRINKS by about one eighth between forming and firing, shrinkage properties must be known in advance, so that insulator size can be accurately maintained. Test bars are extruded, notched and measured before and after drying, as well as after firing.

CLAY SAMPLE, mixed by two augers in a temperature-controlled hopper predicts how material will behave in the plastic state. The applied torque required to deform the clay sample is indicated on a chart.

MATERIALS!

For a brief and complete picture story of suspension insulator quality control, just call your Locke representative.

LOCKE

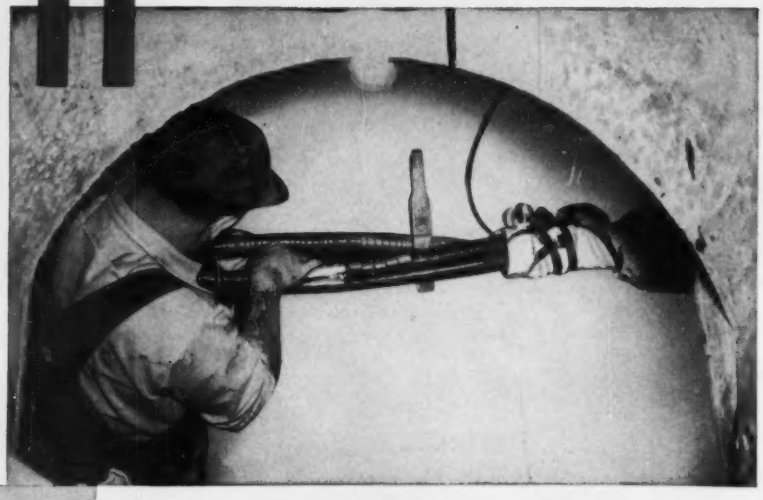
LOCKE DEPARTMENT
GENERAL ELECTRIC COMPANY
BALTIMORE, MARYLAND

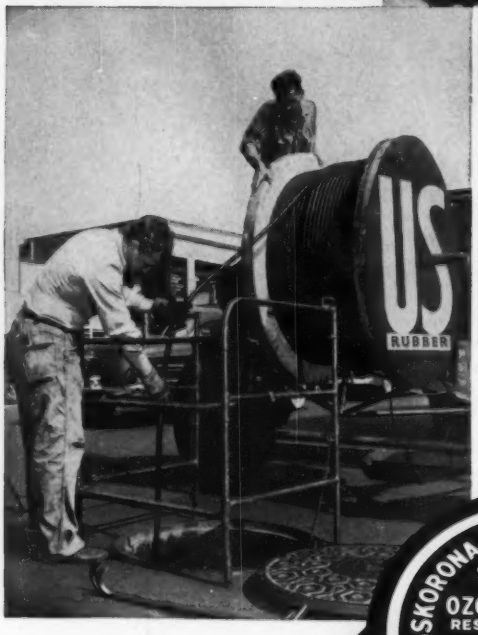
LOCKE Suspension Insulators

Performance Protected by

77 POINT
QUALITY CONTROL

TAPE IT for durability with





USKORONA SPLICING COMPOUND
US
RUBBER
½ IN. WIDE
30 FT. ROLL
OZONE & MOISTURE
RESISTING COMPOUND
Uskorona combines maximum resistance to OZONE and MOISTURE with high tensile strength, elongation and dielectric resistance. Fuses quickly without heat or pressure and makes PERFECT SPLICES.
MADE IN U.S.A.
United States Rubber Company
USKORONA SPLICING COMPOUND

USKORONA

the only tape that resists both moisture and ozone

Uskorona tape will *not* break down. Just how rugged is this tape? Well, in a corona-(ozone) resistance test of 4 leading brands, Uskorona was the only tape still intact after 4 hours of exposure. All others broke down. Even after 1500 additional and *consecutive* hours of exposure, Uskorona remained as fresh and corona-resistant as at the start.

Electrical engineers insist on Uskorona in the design, installation, operation and maintenance of power lines wherever corona or moisture is a problem. Uskorona provides ideal insulation in splicing electrical cables on underground power lines, on secondary network systems, underground street lighting circuits, and transformer leads. It fuses with and becomes a part of the insulation and gives the *same* dielectric strength as the original insulation. Exceeds A. S. T. M. specifications.

Uskorona® is obtainable at any of our selected distributors, any of the 27 "U. S." District Sales Offices, or contact us at Rockefeller Center, New York 20, N. Y.

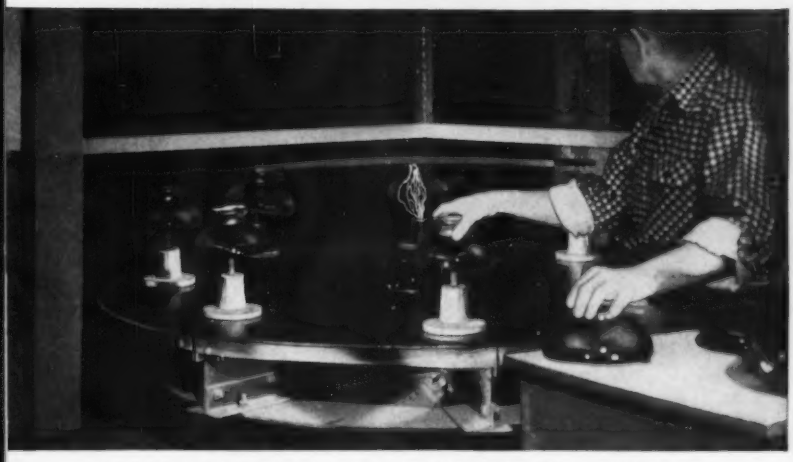
US RUBBER

Mechanical Goods Division

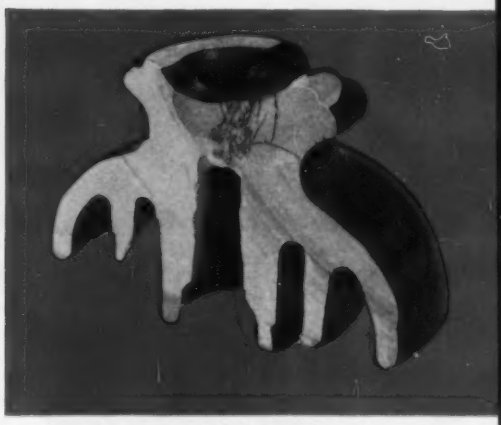
United States Rubber

Insulators out of every finished batch are given this impact test, which checks the mechanical strength and density of the porcelain. Height from which hammer arm drops measures the amount of impact the porcelain will stand.

A corner of Illinois' new large laboratory. Here ceramic engineers test incoming materials, develop new ideas for improved production methods, and test products at various stages during and after production, to assure you dependable finished porcelain.



All Illinois pin-type insulators are given a 100% high voltage flashover test in this test equipment. Voltage builds up until it flashes over, or through, the insulator. If it flashes through, the insulator is, of course, rejected.



Here's a pin-type insulator that failed. This insulator was broken apart to show how the high voltage current searches out even microscopic cracks, like those indicated by the scorched lines at the top. A reject, of course.

Illinois Electric Porcelain is TRIPLE-TESTED . . . and more!

Illinois Electric Porcelain insulators are triple tested to assure the customer that he gets the highest possible quality in electrical porcelain.

Triple-testing is done (1) of incoming materials, in the laboratory; (2) during production, through our extensive quality-control system; and (3) after completion of production, before insulators are shipped, by rigid final testing. Some tests are 100%, like the "M & E" and electrical flashover tests; some are spot checks to destruction, like the impact test and over-voltage pull tests, in which strain insulators are pulled apart while under electrical and mechanical tension, to see how much pull they will take.

Today Illinois Electric Porcelain is producing high quality products with the latest precision production equipment. Illinois' laboratory provides extensive facilities for checking materials and processes, and for devising even more rigorous checks of final production. Galvanizing is done in Illinois' own completely modern galvanizing plant.

The result is that you can depend on Illinois for the highest quality product. Ask the L-M Field Engineer who calls on you for information and copy of Porcelain Bulletin DL8; or write Line Material Company, Milwaukee 1, Wisconsin.

ILLINOIS ELECTRIC PORCELAIN COMPANY

(a McGraw Electric Company Subsidiary) Macomb, Illinois

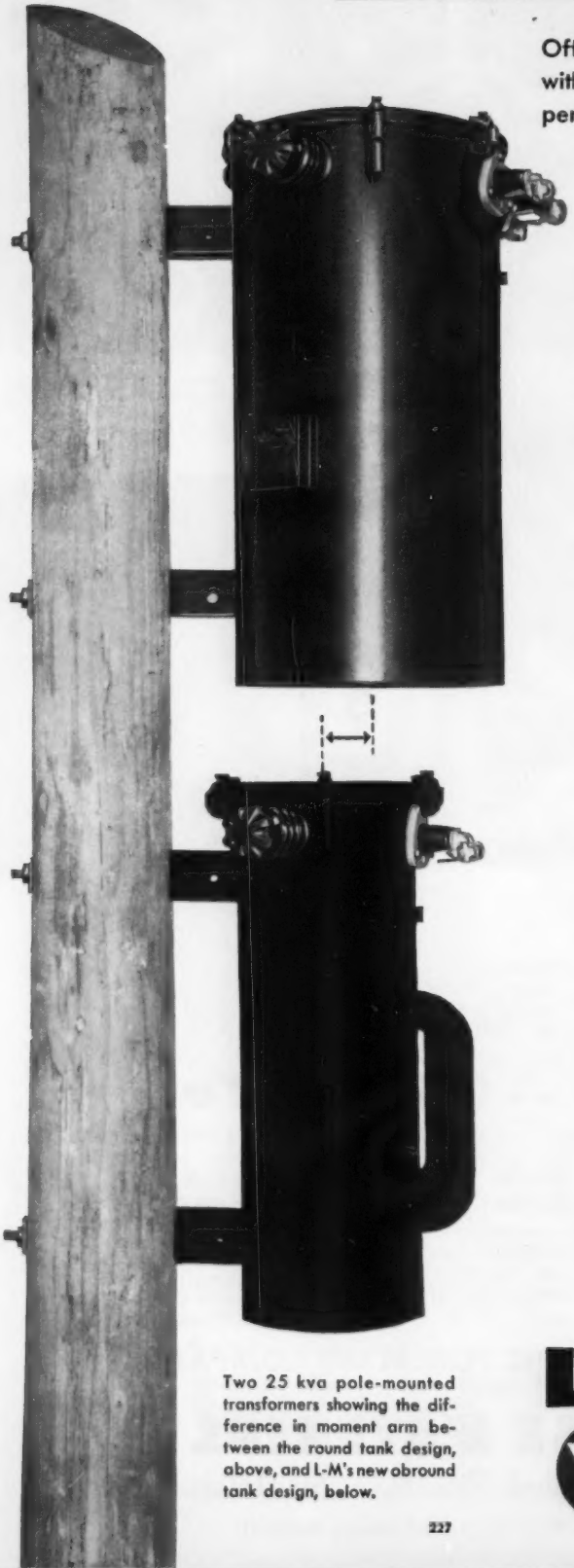
246

Distributed by **LINE MATERIAL**

Electrical Porcelain Insulators

(a McGraw Electric Company Division)

How L-M's New Obround Design Provides 27% Less Bending Moment



Two 25 kva pole-mounted transformers showing the difference in moment arm between the round tank design, above, and L-M's new obround tank design, below.

Offers 33⅓% increase in transformer capacity on a pole, with no sacrifice of L-M's outstanding Round-Wound® performance characteristics.

L-M's new obround tank design is smaller, lighter, and has a shorter moment arm on the pole. The total bending moment is substantially reduced. Thus the potential capacity of all your transformer structures is greatly increased. L-M's new obround tank design retains all the outstanding Round-Wound performance characteristics.

Less Weight, Shorter Moment Arm

The new obround design has a smaller tank with less transformer oil, resulting in a lighter, easier-to-handle transformer. Cooling tubes are installed where required to provide adequate cooling surface. Transfer of heat from copper to outside air is faster and more efficient because of reduced mass.

The new obround design also reduces the moment arm distance from the pole. The combination of less weight and shorter moment arm distance greatly reduces the total bending moment on the pole.

COMPARE 50 kva *round* tank design and L-M's new 50 kva *obround* tank design:

50 kva ROUND tank design:
Moment arm from center of pole.....1.6 ft.
Weight.....860 lbs.
Bending moment 860 x 1.6.....**1,376 ft.-lbs.**

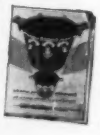
50 kva L-M OBROUND tank design:
Moment arm from center of pole.....1.33 ft.
Weight.....760 lbs.
Bending moment 760 x 1.33.....**1,010 ft.-lbs.**

L-M's new 50 kva *obround* transformer puts *27%* less bending moment on the pole than the 50 kva *round* tank design. That means that you put less strain on your structures—or you can now hang three 50 kva's where you formerly hung three 37½'s—a 33⅓% increase in capacity.

Round-Wound Performance

The advantages of less weight and shorter moment arm were accomplished without changing L-M's outstanding Round-Wound performance characteristics. These characteristics include low exciting current, high impulse strength, high short-circuit strength, and high short-time overload capacity.

Get Details on L-M's Obround Transformer



Ask the L-M Field Engineer for application information, weights and dimensions on L-M obround transformers and the exclusive Round-Wound design. Or write A. B. Coyle, Product Manager, Line Material Company, Transformer Division, Zanesville, Ohio (a McGraw Electric Company Division).

LINE MATERIAL

Transformers

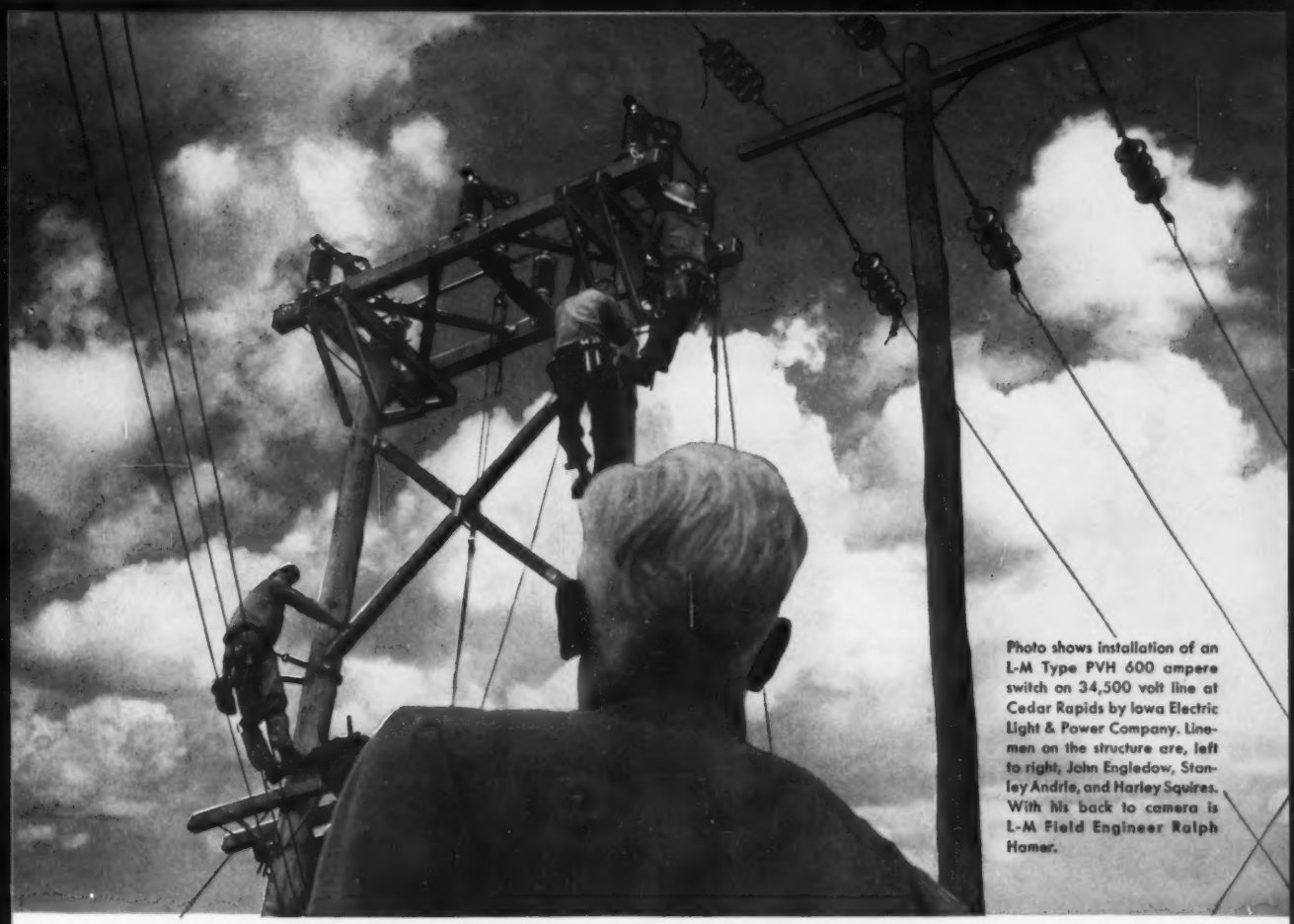


Photo shows installation of an L-M Type PVH 600 ampere switch on 34,500 volt line at Cedar Rapids by Iowa Electric Light & Power Company. Linemen on the structure are, left to right, John Engledow, Stanley Andrle, and Harley Squires. With his back to camera is L-M Field Engineer Ralph Hamer.

Iowa EL&P Installs L-M PVH Switches To Cut Sparkovers on Lightning Surges

by
HOWARD K. HOLLINGSHEAD
District Operating Mgr.
Iowa Electric Light
& Power Company

The photograph shows the installation of an L-M type PVH air break switch on our lines at Cedar Rapids. The new switch replaced an older switch on a point in the lines that is operated "normally open."

The former switch operated satisfactorily as a normally closed switch, but on normally open service the inadequate clearance caused line tripouts and switch insulator damage caused by lightning surges during thunderstorms. During the summer of 1954, eight of the nine insulators on the old switch were damaged.

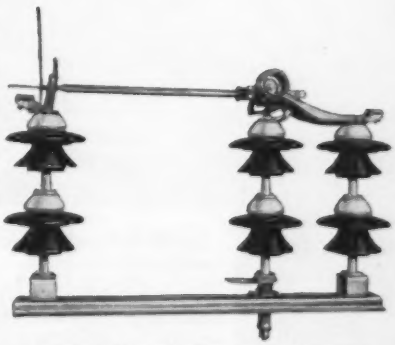
We expect that the new PVH switch has ample clearance and thus will eliminate the trouble. As additional assurance against surges piling up and spilling over, arresters have been installed on each side of the switch one span away.

Since it was not practicable to de-energize the circuits joined at this point during installation time, they were dead-ended temporarily on the single pole shown at the right of the photograph, while the switch is being installed on existing poles.

The new L-M switch is being installed under the supervision of Crew Foreman Howard Norris. He and all the members of the crew were particularly pleased by the rugged simplicity of the PVH switch and the ease of assembly and adjustment. He particularly liked the identification of the interphase bars and the foolproof method of installing them.

Get This Bulletin For Complete Information

L-M offers a complete line of vertical air break and hook switches through 1200 amperes and 69 kv. For information and bulletin ask the L-M Field Engineer; or write Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).



L-M type PVH switches offer ample clearances; castings of aluminum bronze alloy which make them exceptionally strong and light; and the design provides a powerful lever advantage to assure positive operation regardless of ice, corrosion, or long periods of non-operation.

240

LINE MATERIAL
Power Switching Equipment

Leads of 48-inch 600-volt #12 wire furnished as standard equipment.

Bushing-Mounted Indicating Fuse with 48-inch lead can be supplied.

Solder-Sealed Bushings of strong one-piece wet-process porcelain provide a positive, lasting seal.

Pole-Mounting Bracket has two 9/16" holes for ½" lag screws. Standard EEI-NEMA crossarm-mounting bracket furnished if required. Capacitor can be mounted with bushings up or down.

Aluminum Metallizing process protects steel tank from oxidation; is followed by a chromate primer and a finish coat of alkyd resin paint.

Single-Pack, Round-Tank Design makes these capacitors small, light, easy to install. Unit has a one-minute discharge resistor; is completely impregnated under vacuum with low temperature Elemex liquid dielectric.

LM® **LINE MATERIAL**

L-M's 7½ kvar capacitor is 23½" high and weighs only 33 lbs. The 5 kvar is 18⅜" high, weighs 25 lbs. The 3 kvar is 13¾" high, weighs 18 lbs. Weights include pole-mounting brackets. Standard EEI-NEMA crossarm-mounting bracket furnished if desired.

L-M's unique shipping carton permits inspecting and testing capacitors without removing them from the carton, simply by opening the end flap—which can be resealed.

Small, Light, Easy to Install . . .

L-M's New Secondary Capacitors Provide Needed Vars For Air-Conditioning Loads

Solder-sealed bushings, aluminum metallized finish on tank, and single-pack construction assure long life, low maintenance.

By **BLAINE SCHULTZ**
Chief Engineer
Capacitors
Line Material Company

L-M's new secondary capacitor is your solution to the problem of poor voltage regulation and overloaded transformers caused by low-power-factor air-conditioning loads.

The unit is small, light, and rugged; easy to install on crossarm or direct pole mounting. It offers you outstanding design features, such as aluminum metallized tanks, solder-sealed bushings, one-minute discharge resistor, single-pack round-tank construction, and low-temperature Elemex liquid dielectric.

Protective Coating

L-M's unique aluminum metallizing process prevents oxidation of the steel tank and greatly extends the life of the capacitor. This process is followed by a chromate primer and a finish coat of alkyd resin paint. The finish coat is dark in color to facilitate heat radiation and keep the capacitor at low operating temperatures.

Solder-Sealed Bushings

Strong solder-sealed bushings of one-piece wet-process porcelain provide a positive, lasting seal. By eliminating gaskets and clamps we eliminate leakage. Therefore the capacitor can be mounted with bushings up or down.

Pack Construction

The packs are assembled in air-conditioned rooms to assure uniformity and are tested with over-voltage to eliminate any actual or potential defects. The units have a one-minute discharge resistor to assure safe handling and storage.

L-M's new 240-volt, pole-mounted, secondary capacitors are available in 3, 5 and 7½ kvar. 48-inch leads are furnished and external bushing-mounted indicating fuses can be supplied when required.

Ask us for complete information

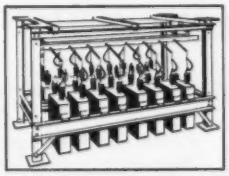
Ask the L-M Field Engineer for complete information on construction and application of L-M's secondary pole-mounted and submersible capacitor equipments, 2400- to 13,800-volt 15, 25, and 50 kvar capacitors, and our capacitor bank engineering service. Or write Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

Elemex® Capacitors

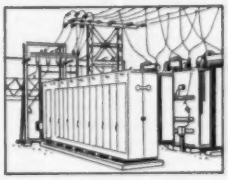
235-R

Other L-M Capacitor Equipments

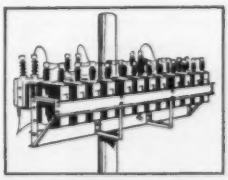
L-M offers a complete line of power capacitor equipments, such as these:



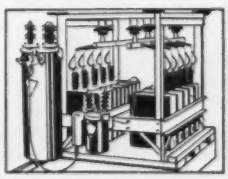
Factory-assembled blocks, which save time and money in building large banks.



Metal-enclosed capacitor equipments in all NEMA-standard sizes and ratings.



Factory-assembled racks for pole-mounted banks, both three-row and single-row styles.



VDS-Method factory-assembled block for multi-step bank switching—an exclusive L-M method that offers a substantial saving on switching equipment.

Also custom-designed protective and switching schemes.

NEW

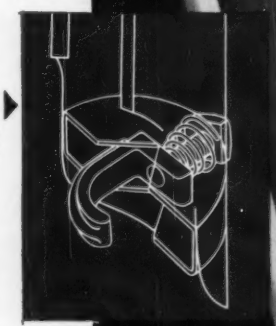
E-M ALUMINUM-COATED GUY GUARDS

cost no more than galvanized— yet last THREE TIMES longer!

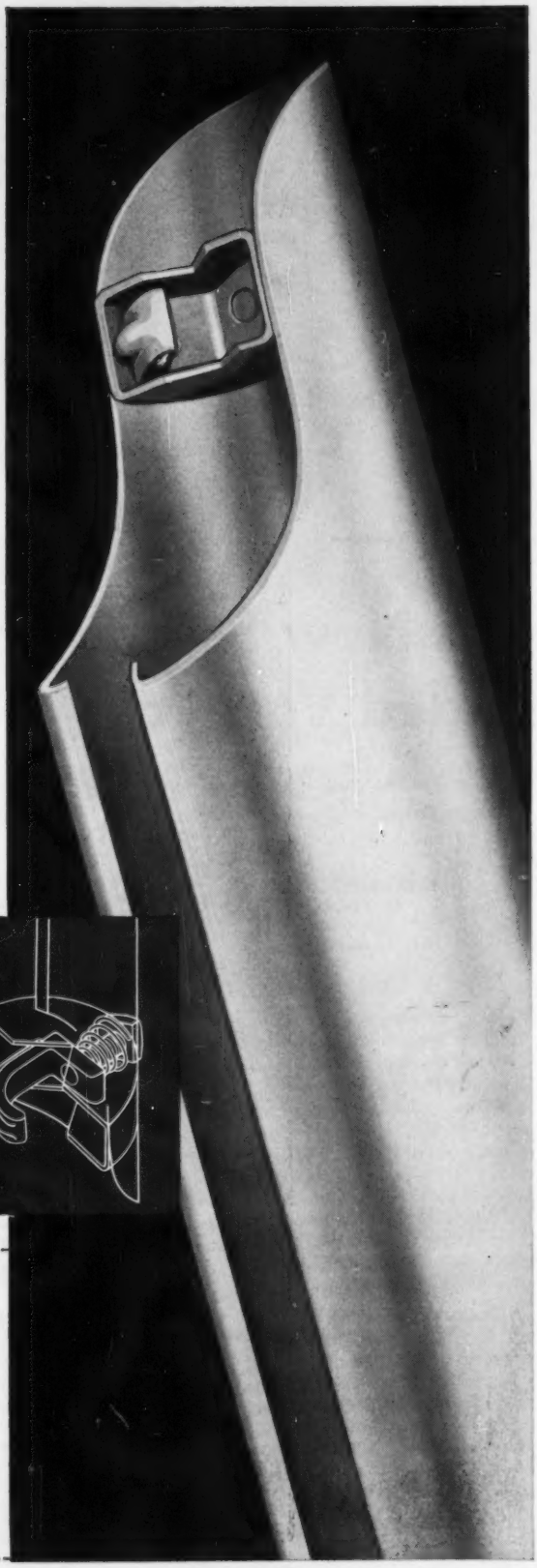
Here are the facts about the remarkable new E-M (Electrical Manufacturing Company) guy guard!

- It's the first item of pole-line hardware now in production utilizing E-M's new hot-dip aluminum coating, ALUDUR®.
- ALUDUR-coated steel is half again more reflective than galvanized, thus providing an important additional factor of safety.
- Same strength as galvanized.
- Gives three times the service life of galvanized. (Your own records will probably show that guy guards are the most frequently replaced item of line hardware.)
- Ingenious new ALUDUR-coated malleable iron clamp automatically snaps over anchor rod. Guard can be installed in 30 seconds.
- **Now available at same price as galvanized.**
- You can't lose by mailing the coupon below, for a sample of the new E-M ALUDUR-coated guy guard.

®ALUDUR is a registered trade name of Electrical Manufacturing Co.



Phantom view of bottom clamp shown above. Clamp snaps over anchor rod requiring only tightening of bolt.



EM

ELECTRICAL MANUFACTURING COMPANY
Battle Creek, Michigan

Designers and manufacturers of pole-line hardware that saves you time, money, and maintenance. Prompt action on special problems.

59

Send us a FREE SAMPLE of the new ALUDUR-coated E-M guy guard.

☐ 8 ft. full round 18 Ga. No. 8255
☐ 8 ft. half round 14 Ga. No. 8258

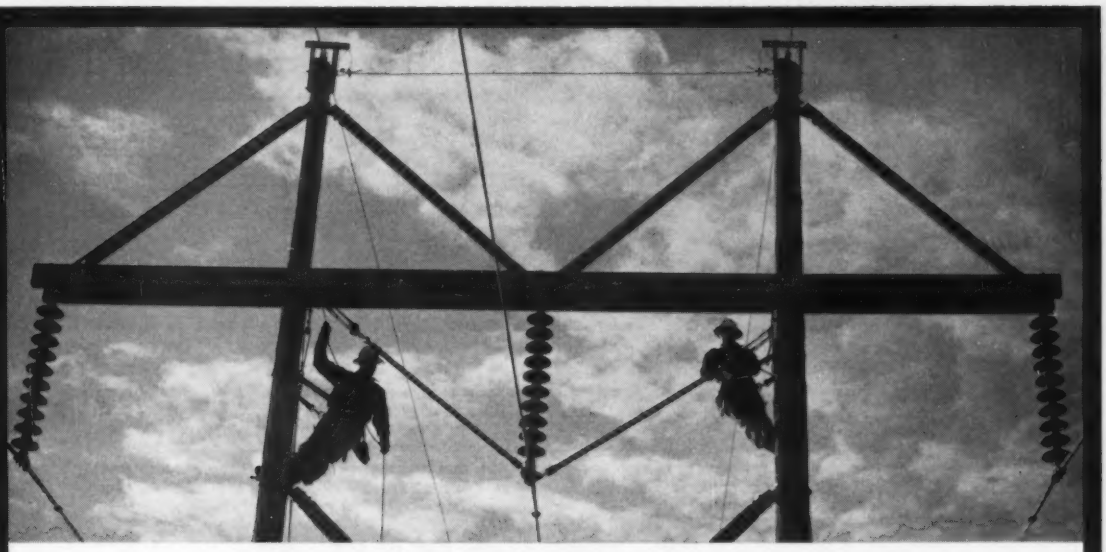
Name_____

Title_____

Company_____

Address_____

City_____ State_____

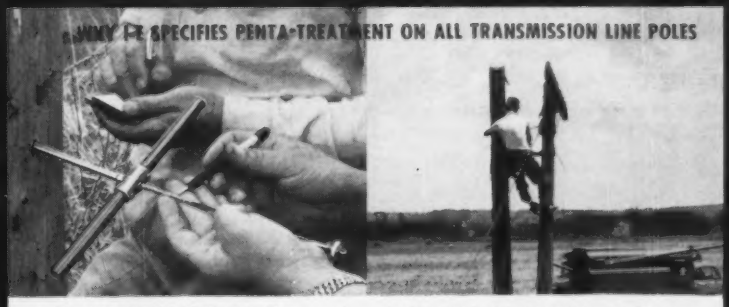


IOWA ELECTRIC LIGHT AND POWER SAYS:

"First Penta-treated poles set in '41...still no sign of deterioration!"

"This company started using Penta-treated poles in 1941. After 15 years, there is no sign of deterioration in any of these poles. I would say that our experience with Penta-treatment has been most satisfactory. We specify full-length Penta-treatment on all transmission line poles."

Allen Hird, Transmission and Distribution Engineer



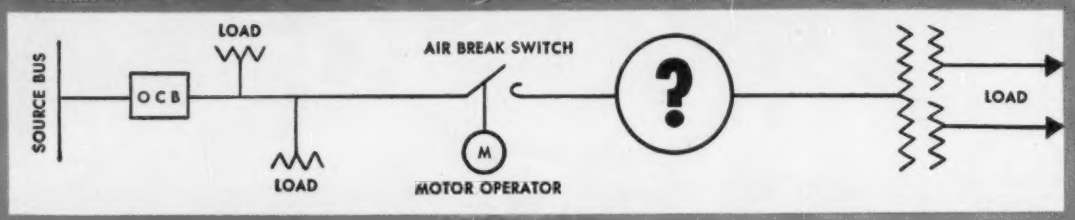
1. MEASURABLE PROTECTION. Increment borings of wood can be chemically analyzed to determine the *exact* amount of Penta present. Heat, rain, frost or snow can't bleed or leach Penta out of wood. Penta offers lasting protection against decay and insects.

2. CLEANER TO HANDLE, MAINTAIN. Poles treated with Monsanto Penta are cleaner than poles treated with other preservatives. Penta stays locked in wood, can't bleed or leach out. And Penta-treated wood won't "burn" hands, stain clothes.

Monsanto Penta protects poles, crossarms, transformer platforms, braces, control boxes, planking. For list of treating plants serving America's utilities... and FREE Penta "Poles and Crossarms" booklet, write: Organic Chemicals Division, MONSANTO CHEMICAL COMPANY, Dept. PI-2, St. Louis 1, Missouri.

MONSANTO ®

HOW WOULD YOU PROTECT THIS TRANSFORMER ?



SOUTHERN STATES TYPE HRS SAVES COST OF EXPENSIVE OIL CIRCUIT BREAKER

The problem presented in the schematic diagram above is to provide adequate internal fault protection for a power transformer. One solution would be to install a high side oil circuit breaker. However, this represents a large capital outlay—and, under many conditions, might not be justifiable.

The most practical solution would be to use the source breaker to clear the line should a damaging fault condition develop in the transformer; however, in the above case, transformer impedance is great enough to limit current to values below trip settings for the source breaker relays.

The answer is to install Southern States Type HRS Automatic High Speed Short Circuiting Switch. As soon as such a fault condition develops, the Type HRS, tripped by differential relays, imposes a deliberate ground fault on the line. The source breaker opens, clears the line, and the transformer is protected.

In order to isolate the transformer from the feeder, it is customary to install an air switch on the feeder between the short circuiting switch and the source breaker. Service continuity on the remainder of the feeder, after the HRS operates, can be maintained by providing the air switch with a spring or motor operator. Suitable under-voltage timing relays will automatically open the air switch before the first delayed reclosure. Service is then restored to the remainder of the line.

For a low capital investment and reliable protection, choose the Type HRS. Complete details are available in Bulletin 55 HRS.

Available in Voltage Ratings of 34.5 KV through 161 KV and momentary current ratings of 20,000 amperes and a 4-second rating of 12,600 amperes.

SOUTHERN STATES EQUIPMENT CORP.
HAMPTON, GEORGIA

IN CANADA: Dominion Cutout Co., Ltd., Toronto

Get Voltage Data the Continuous Low-Cost Way with Lincoln Voltmeters

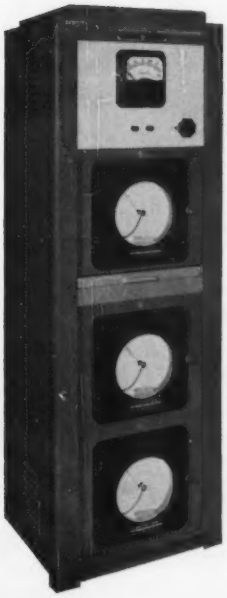
You can't give proper service without proper voltage. And rapid load growth has made expensive, periodic surveys unreliable.

Permanent installations of Lincoln *Indicating* Voltmeters provide a constant record of maximum and minimum voltages for all interested personnel at low capital investment.

Lincoln *Graphic* Voltmeters are available for use where more detailed information of time and duration of voltage is required.

Get the whole story—write for "Solving Distribution System Problems through Measurement."

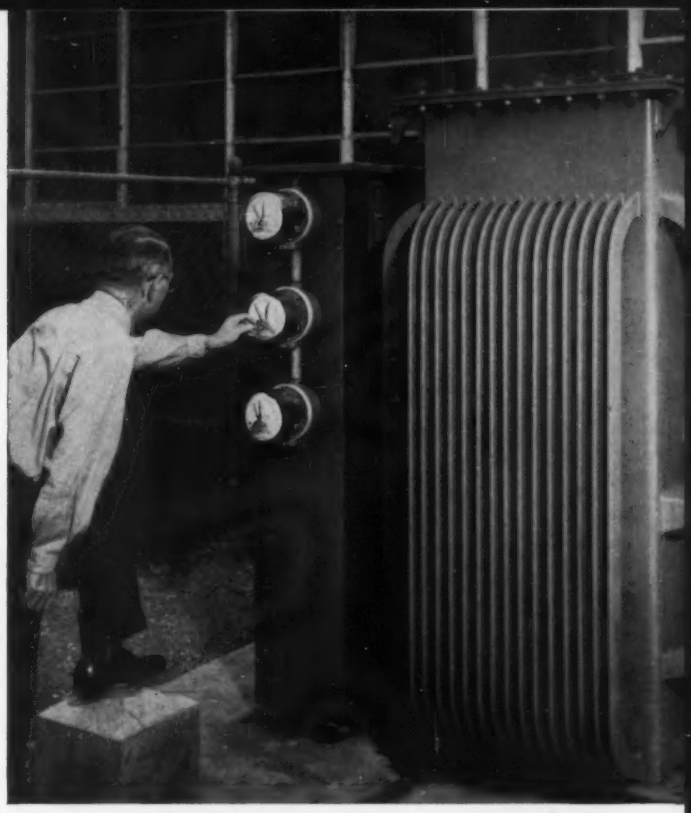
SANGAMO ELECTRIC COMPANY
SPRINGFIELD, ILLINOIS



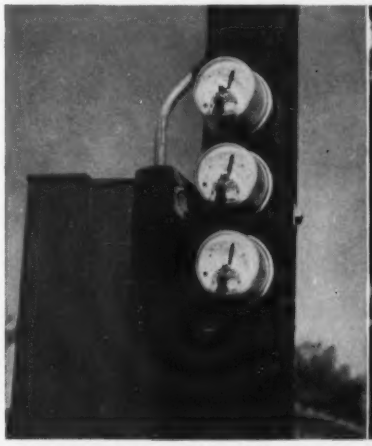
Lincoln graphic voltmeters with monthly charts tell operating manager of phase voltages at primary substation.

Complete information is obtained on circuit conditions with Lincoln meters measuring watts, vars, amperes, and volts.

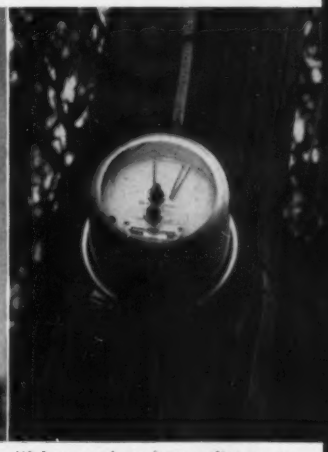
SM56-4



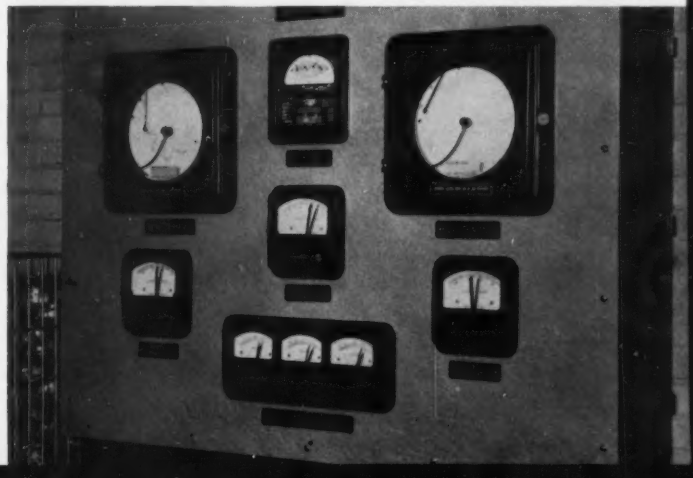
Voltage and current in this three phase transformer are being measured with a Lincoln V2S Voltmeter and two Lincoln ADS Ammeters.

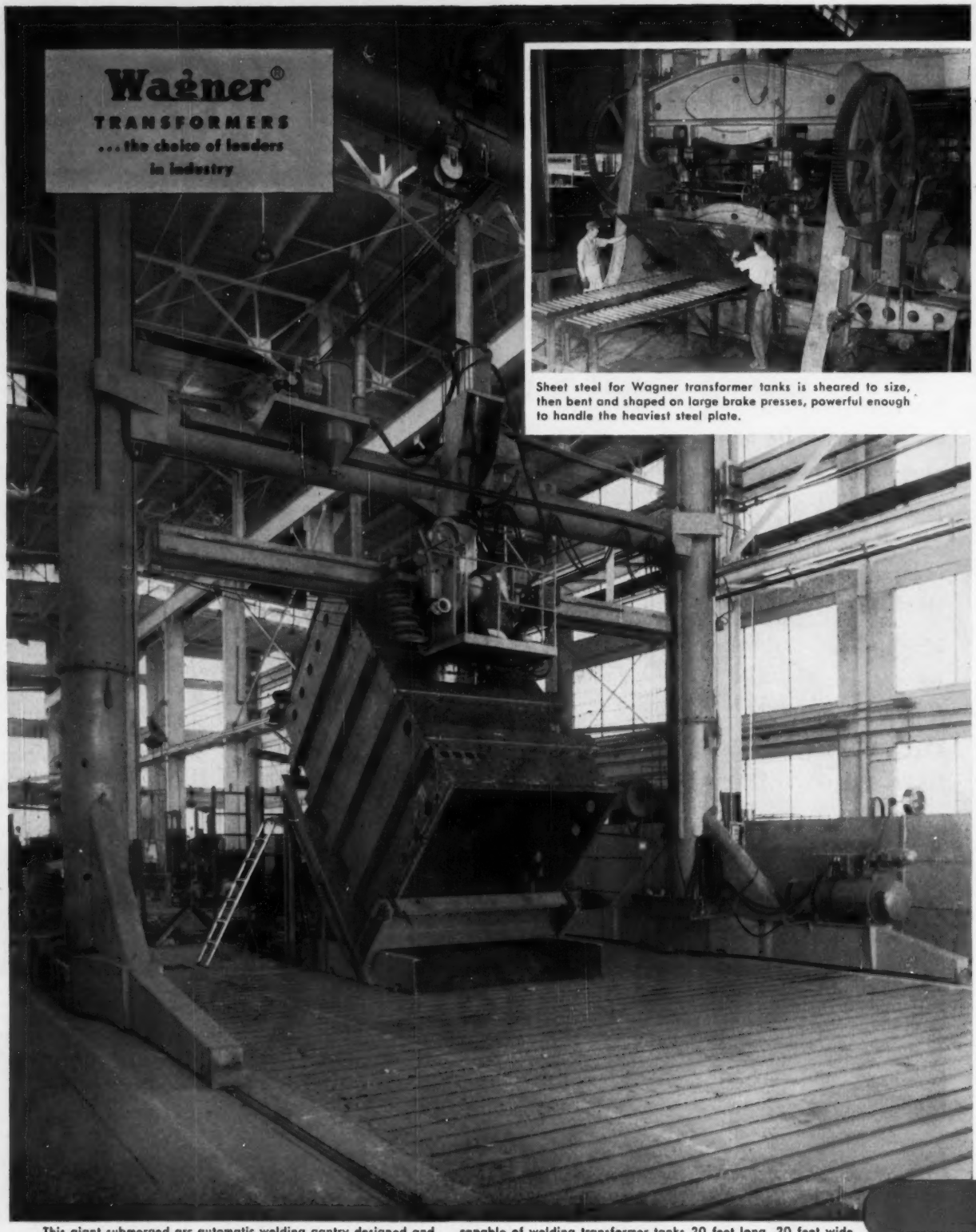


Three V2S Voltmeters check supply voltage at metering point to an industrial power customer.



Minimum and maximum voltage continuously checked on singlephase residential circuit with Lincoln Voltmeter.

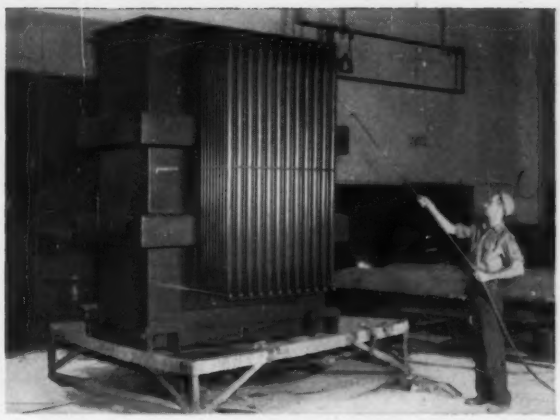




Sheet steel for Wagner transformer tanks is sheared to size, then bent and shaped on large brake presses, powerful enough to handle the heaviest steel plate.

This giant submerged arc automatic welding gantry designed and built under the direction of Wagner's engineers assures strong, uniform, leak-proof welds for longer-lasting transformers. It is capable of welding transformer tanks 20 feet long, 20 feet wide and 16 feet high. Controlled from one central station by a single operator, it can make smooth, continuous welds 17 feet long.

The worker in the "Man-from-Mars" costume is a sandblaster. After welding, the completed tank is carefully tested for leaks and then sandblasted to remove all rust, dirt and scale.



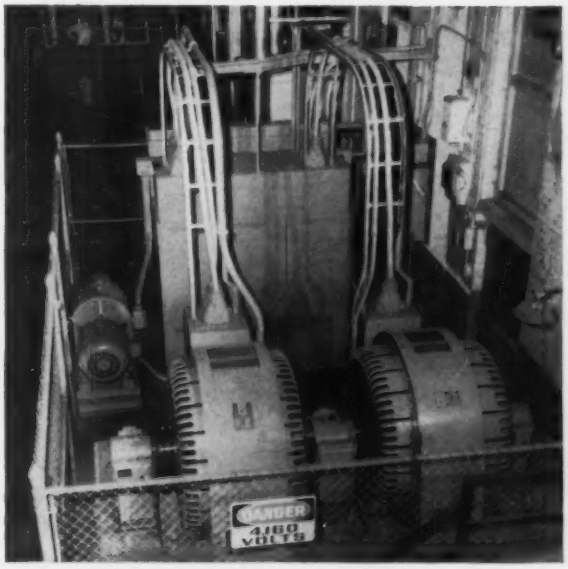
All tanks receive three coats of special paint applied by the flow painting process for long-lasting protection on all surfaces. Each coat is thoroughly dried and hardened in a baking oven.

Here's why the Wagner power transformers you buy give longer service life

Come inside Wagner's transformer plants. Here you'll find the most modern transformer production facilities manned by skilled technicians and all of it backed by Wagner's better-than-sixty-years of transformer building experience...

Wagner's insistence on the use of only the highest quality materials — carefully controlled production methods — rigid inspections and tests — all combine to assure you of power transformers that will provide the utmost in reliability and service continuity.

It will pay you to consult Wagner on your next power transformer installation. The Wagner Electric Corporation maintains thirty-two branch offices, located in principal cities, for quick convenient engineering service and consultation.



A 300 cycle generator for performing NEMA Standard induced voltage tests of turn-to-turn and major insulation. This is one of many tests made to insure that Wagner transformers meet all standards.

Wagner Electric Corporation
EST. 1891

WAGNER ELECTRIC CORPORATION
6456 Plymouth Ave. • St. Louis 14, Mo., U. S. A.

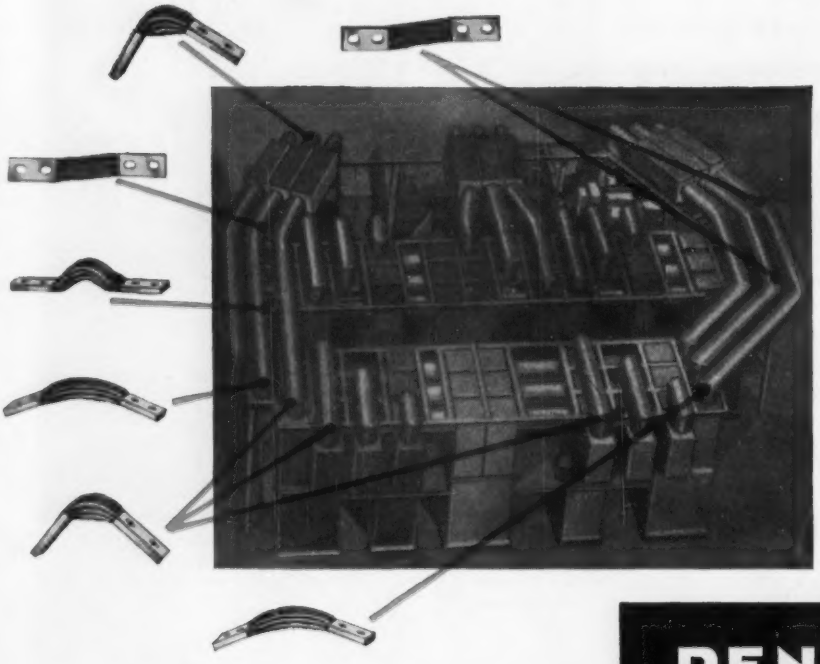
ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS — AIR AND HYDRAULIC

BRANCHES IN 32 PRINCIPAL CITIES

T56-2

When you need Multiple Braid Con

. . . ask PENN-UNION. Find out how we can help you on problems of conductor expansion and alignment, with Multiple Braid Connections . . . and a complete line of standard fittings, including bus supports . . . plus the know-how to design and make the most difficult "specials."



Westinghouse Isolated Phase Bus connecting outdoor switchgear to two 40,000 KVA 69-11 KV transformers. Duquesne Light Company, Forbes SubStation. Penn-Union Multiple Braid Connectors, at the end of each bus conductor, provide for expansion and contraction . . . . . also used for bushing connections and at vibration joints.

PENN-UNION

Write for Catalog Sheets showing these and other Penn-Union Multiple Braid Conductor Fittings.

ANY nector

THIS ONE WASN'T EASY . . .
a leading electrical equipment manufacturer needed it, produced to very close tolerances . . . *"doing the tough jobs a little better"* is a Penn-Union habit.

Penn-Union Electric Corporation, Erie, Penna.

Please send Catalog Sheets showing Penn-Union Multiple Braid Connectors.

(Name)_____

(Company)_____

(Address)_____

NEW! "BUFFALO"

a new high

MOST STREAMLINED INLET — note smooth inlet bell matching the deep drawn wheel flange to form a "true half circle" inlet into wheel.

DEEPER BLADES FOR DEEPER "BITE" — note exceptionally deep blade design in photo below. This improves air flow thru blade channels. Flanged hubs—smoothly curved for best air entry conditions.

The wheel has been dynamically tested in the "Buffalo" Vacuum Pit — possible only at "Buffalo". By spinning various rotor designs to destruction the optimum wheel construction was determined — another "Buffalo" "Q" factor.*

"Buffalo" Air Foil Wheel. Note "deep-bite" blades for most efficient air handling.

**The "Q" Factor — the*

BUFFALO

BUFFALO,

Canadian Blower &

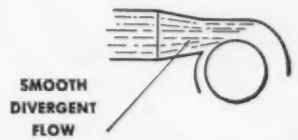
VENTILATING AIR CLEANING AIR TEMPERING PRESSURE BLOWING

"Deep Blade" AIR FOIL FANS

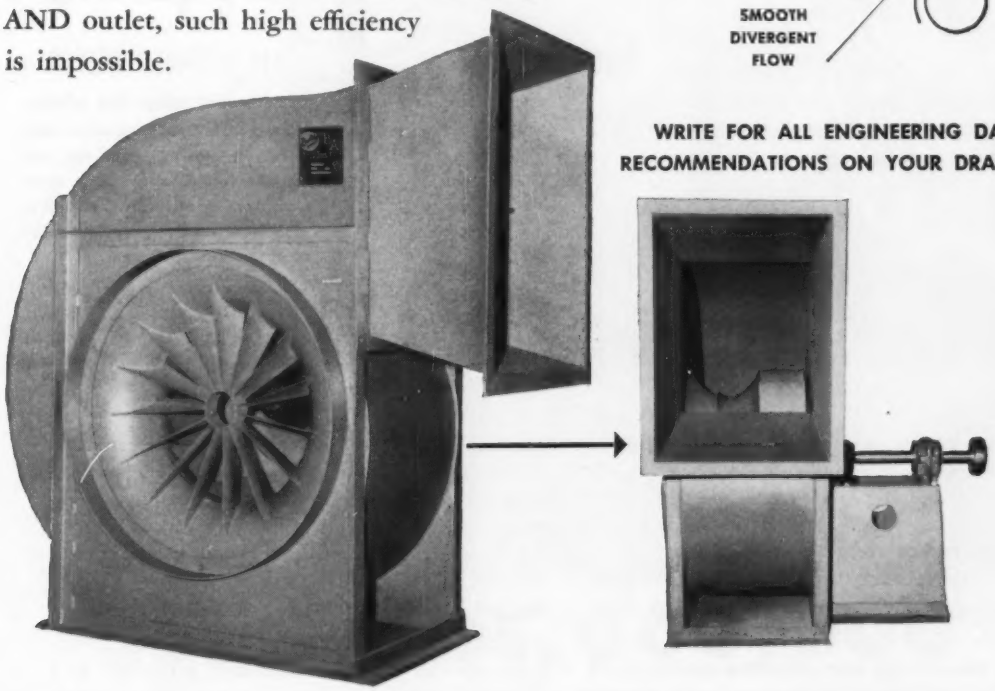
in forced draft performance

IMPROVED FAN OUTLET — reduces outlet air turbulence from fan cutoff into duct by making more even, gradual change from velocity to static pressure. Without this complete streamlining of inlet, housing AND outlet, such high efficiency is impossible.

92% MECHANICAL EFFICIENCY — not an inflated claim, but proved performance you can expect in field operation.



WRITE FOR ALL ENGINEERING DATA AND RECOMMENDATIONS ON YOUR DRAFT PROBLEM



built-in Quality which provides trouble-free satisfaction and long life.

FORGE COMPANY

"Buffalo"

NEW YORK

Forge Co., Ltd., Kitchener, Ont.

INDUCED DRAFT EXHAUSTING FORCED DRAFT COOLING HEATING

Widespread Acceptance of Hotpoint Automatic Clothes Dryers

Increases Utility Revenue!

Hotpoint

SUPER DE LUXE SEALED-CHAMBER DRYER

No venting required! (1) Purified, heated dry air (2) takes moisture and lint from clothes (3) cold water spray condenses moisture (4) lint and water are pumped down into the drain.

Hotpoint

AIR-BLOWER DRYER

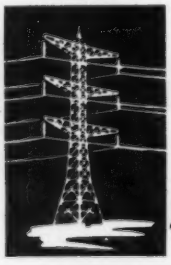
One connection for either 115 or 230-volt operation! Hotpoint quality, features and construction, in a low price automatic featuring Air-Blower drying. New Wide-Screen Lint Filter is convenient, efficient.

Promote the load that promotes profits! More Dryers on your lines mean greater revenue for you. Automatic Clothes Dryers use an average of over 750 Kilowatt hours annually—***and that usage is almost entirely concentrated in off-peak hours!*** With the demand for Dryers more than tripled in just five years, opportunities for increased utility revenue are better than ever.

Promote the dryers that promote acceptance! Hotpoint's leadership in engineering has accelerated consumer acceptance through ***exclusive*** automatic features and dependability of operation. The amazing Hotpoint Sealed Chamber Dryer requires ***no venting*** yet moisture, heat and lint cannot escape into the room. And famous Hotpoint quality and performance are also available in the low-cost Hotpoint Air-Blower Dryer that can be used on either 115 or 230-volt circuit!

Promote the line that helps you promote! Hotpoint provides you with established acceptance in a wide-open market—and backs you up with an aggressive, hard-hitting merchandising program designed specifically for utility use. Get the complete story on how Hotpoint can help ***you*** increase ***your*** revenue. See your Hotpoint Distributor—***soon!***

Again, Hotpoint

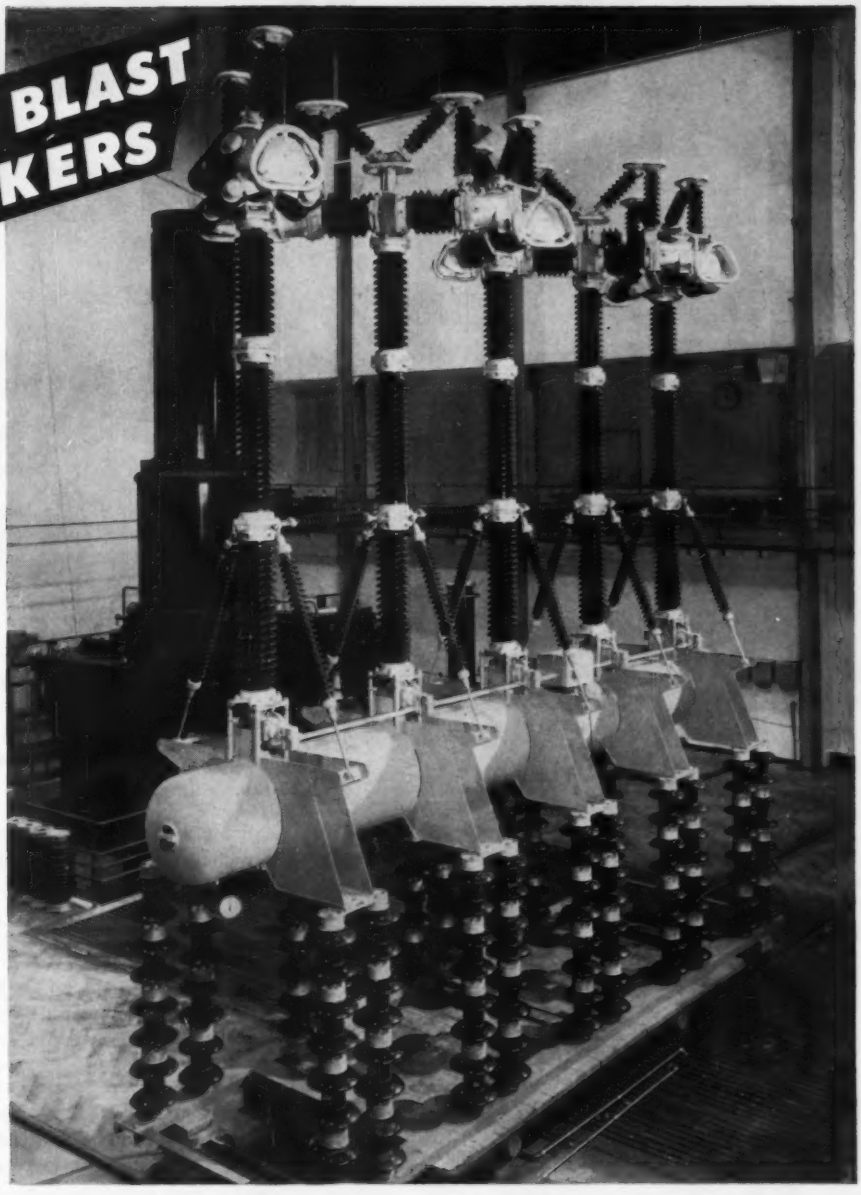


looks at Tomorrow, Today!

HOTPOINT CO. *(A Division of General Electric Company)* **5600 West Taylor Street, Chicago 44, Illinois**

BROWN BOVERI

AIR BLAST BREAKERS



One pole of

330 kv 25,000,000 kva
BROWN BOVERI AIR BLAST BREAKER

for installation in the United States,
set up for special impulse coordination tests.

BROWN BOVERI

BROWN BOVERI CORPORATION

19 RECTOR STREET • NEW YORK 6, N. Y.

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Detroit, Mich. • High Point, N.C. • Jacksonville, Fla. • Kansas City, Mo. • Knoxville, Tenn. • Lewiston, Me. • Los Angeles, Cal.
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YOU HAVE A

1

CROSS-ARM MOUNTING

Crystal Valve External Gap Arrester for Cross-arm Mounting. Maximum permissible line-to-ground voltages 6,000 to 18,000.

Crystal Valve All-Porcelain Enclosed Gap Arrester for Cross-Arm Mounting. Line-stud Ground-stud Terminals. Maximum permissible line-to-ground voltages 3,000 to 18,000.

Your choice of mounting is only one advantage of Crystal Valve Lightning Arresters. Most important advantages to distribution engineers are greatly reduced operating and maintenance costs . . . increased efficiency of the entire distribution system . . . negligible outages during lightning season.

You also have a choice of the type of Crystal Valve Lightning Arrester—with isolating external gap or full enclosed gap; The isolating gap provides positive protection from line lockouts. The fully enclosed gap is weatherproof and has provided positive protection for many years. Both Crystal Valve arresters have:

Exclusive "T" Grain Silicon Carbide Valve Element which is unaffected by moisture or age. It has the highest thermal and surge current capacity of any valve element material.

Ultra-Speed Multiple Arcing assures low impulse sparkover. A series of small spark gaps, instead of a single large gap, electrodes which discharge between smooth, flat surfaces; accurately ground Steatite spacers between gap electrodes . . . these guarantee high speed protection.

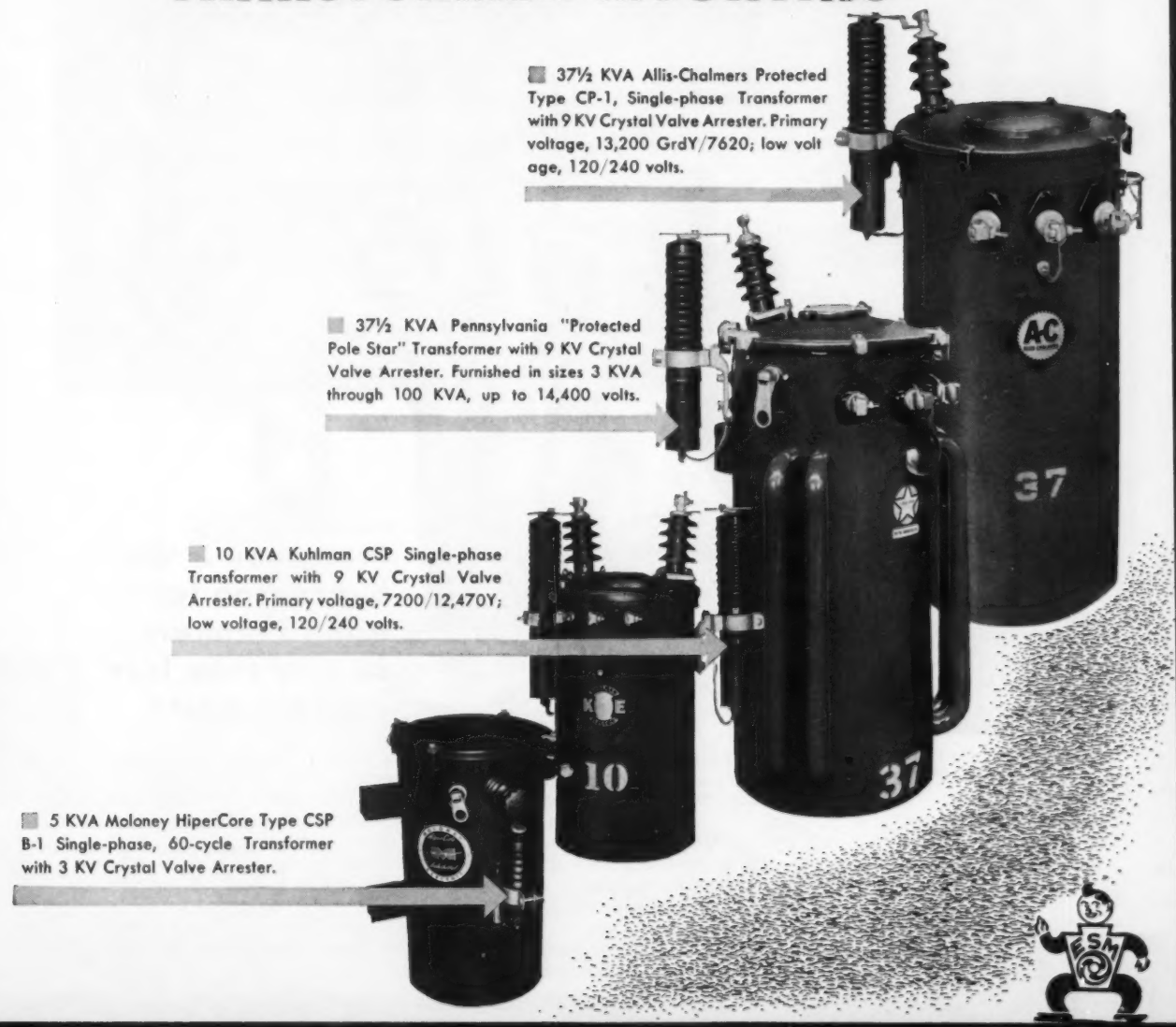
Thousands of CV Arresters are giving permanent protection to power lines on cross arms . . . and on transformers under all types of weather conditions. That is why leading utility companies have specified CV Arresters on their lines for more than 35 years . . . why leading transformer manufacturers furnish their product with CV Arresters. They know Crystal Valves give unlimited surge capacity at all ratings and can be installed on all types of circuits without regard to system capacity.

Write today for your copy of "Proved Protection" giving all of the inside facts you should consider in selecting lightning arresters.

CRYSTAL VALVE

LIGHTNING ARRESTERS

2 WAY CHOICE WITH
CRYSTAL VALVE ARRESTERS
2
TRANSFORMER MOUNTING


37½ KVA Allis-Chalmers Protected Type CP-1, Single-phase Transformer with 9 KV Crystal Valve Arrester. Primary voltage, 13,200 GrdY/7620; low voltage, 120/240 volts.
37½ KVA Pennsylvania "Protected Pole Star" Transformer with 9 KV Crystal Valve Arrester. Furnished in sizes 3 KVA through 100 KVA, up to 14,400 volts.
10 KVA Kuhlman CSP Single-phase Transformer with 9 KV Crystal Valve Arrester. Primary voltage, 7200/12,470Y; low voltage, 120/240 volts.
5 KVA Moloney HiperCore Type CSP B-1 Single-phase, 60-cycle Transformer with 3 KV Crystal Valve Arrester.
37
10
37

Electric Service Manufacturing Co.

PHILADELPHIA 32, PENNSYLVANIA

Represented in Canada by Lyman Tube and Bearings, Ltd., Montreal and Toronto

For system safety

3 TANKS

are needed in outdoor Distribution Breakers

ALLIS-CHALMERS
for Progress in
SWITCHGEAR

Protection is the big reason for using breakers, so why take less than the best?

● Allis-Chalmers provides a tank for each phase . . . three tanks instead of one . . . to eliminate the danger of internal phase-to-phase flashover usually caused by line-to-ground fault. Maintenance is reduced, since only the faulted phase is affected. Three-tank breakers provide greater system safety than single-tank units, yet cost *you* no more.

Tank-per-phase construction and mechanically trip-free operation are but two of many quality features in Allis-Chalmers 14.4 and 23-kv outdoor distribution breakers.

Get Complete Data — Ask your nearby Allis-Chalmers office for complete information, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin, for Bulletin 71B7946. A-4894

A-C ALLIS-CHALMERS

ALLIS-CHALMERS

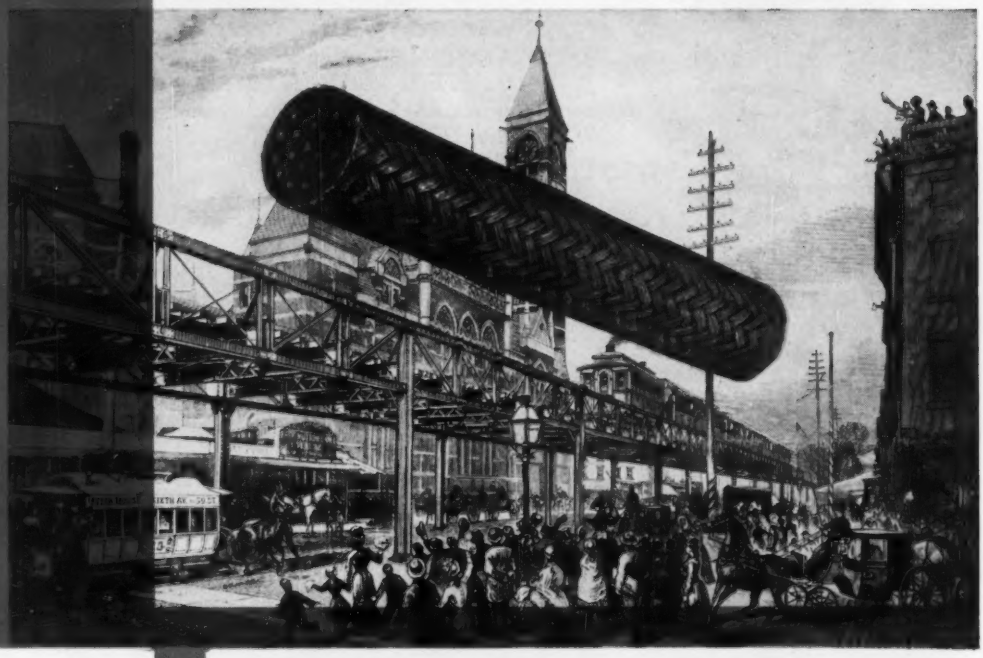
MORE FOR YOUR MONEY THAN EVER BEFORE is offered by Lapp suspension discs. Their mechanical strength and electrical permanence provide an extra margin of operating security. They can be sold at today's low prices only because of automation and control in manufacturing processes. And the resulting uniformity pays an operating bonus in their uniform trouble-free long life.

Lapp

THIS IS AUTOMATIC FINISHING. The outside surface of every Lapp suspension insulator is finished on a machine like this, an air-operated mechanism feeding the cutting tool into the work to shape head and shell in a single cut. The "stock" is the clay blank, which has been formed by hot pressing, and dried to exact moisture content—to assure control to tight dimensional tolerances during subsequent drying and firing. The result is *uniformity* of insulator production . . . low insulator prices . . . high insulator quality, performance and reliability.

Lapp Insulator Co., Inc., Le Roy, N. Y.

Kerite cables aided in the development of New York's rapid transit. Pictured is the first train on the Gilbert Elevated Railroad passing through 6th Avenue, near Jefferson Market Court, April 28, 1878.



DEPENDABILITY

The Kerite Company has been identified with industrial progress in this country for the past century. Now in its second century, Kerite remains humbly dedicated to offering the best in quality and service.

The value and service life of a product can be no greater than the integrity and craftsmanship of its maker.

KERITE CABLE

THE KERITE COMPANY—30 Church St., New York 7, N. Y.
Offices also at 122 S. Michigan Ave., Chicago; 582 Market St., San Francisco;
3901 San Fernando Rd., Glendale 4, Calif.: 31 St. James Ave., Boston

Founded 1854

EDITORIALS

Modern Maintenance Demands New Skills

Maintenance is big business. Utilities have appropriated $597 million for this function in 1956. But this is only a part of the price for keeping power systems in sound operating condition. Operating expenditures for testing, patrolling, tree trimming, and record keeping are closely related to maintenance. Add these to the budget for maintenance functions, and the total is nearly $1 billion a year.

Modern maintenance is complex. Larger, more complicated electrical systems create problems in operation and maintenance, as in design, which completely eclipse those of the recent past. Spare lines and equipment, which simplified maintenance tasks and made them less pressing, are not so plentiful as in the past. More detailed maintenance records offer many advantages but also make new demands on maintenance personnel.

Maintenance today is an engineering job as exacting as any in the industry. It is a job for specialists continuously alert for early symptoms of trouble and able to devise effective and economical remedies under relentless pressure. No longer is it sufficient that maintenance men be handy with wrenches and screwdrivers. Their tool kit today includes oscilloscopes, microphones, vibration detectors, and even a slide rule.

Maintenance management should guide and support its engineers in their quest for improved methods and adequate records. It should help them to build up a corps of technicians and mechanics trained to handle the work. And as the job of maintenance grows larger and more complex, maintenance supervisors must prepare to play a bigger role in utility management.

You Can Talk on Automation

Many industrial firms are looking toward some form of automation to increase production efficiency. They are finding it no simple matter. Not only does automation require extensive re-planning of production processes, but it raises numerous personnel problems. These are gradually moving toward ideological debates on the merits of automation.

Here's where electric utilities can give a big hand to other industry. Automation and mechanization are long established in electric utility operations. Probably no other segment of industry is as well qualified to expound on the benefits of automation or supply evidence for the ideological battle.

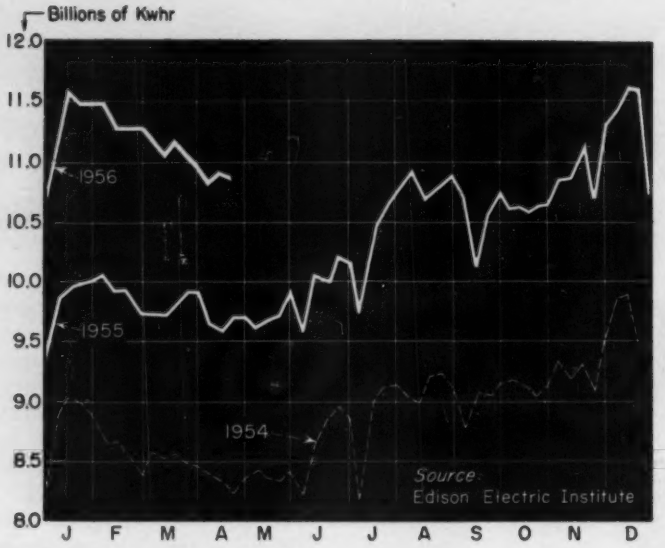
Modern steam stations are among the most automated plants for their size in operation today. Automatic substations match the complexity of most automated production machines. Automation in one form or another is moving into utility accounting, billing, and system dispatching, and is being employed as an aid in system planning. The electric utility industry has seldom passed an opportunity to bring more automatic control into its operations.

The results are impressive in any argument that will arise, for the benefits of automation in our industry have been widely distributed. In the past 25 years the industry has increased production some 500% with an increase of only 60% in working force. Utility workers have benefited by improvement in job quality and higher salaries. Customers have benefited by improved service reliability and lower power costs. The industry has benefited by being able to supply the rapidly mounting demand for power promptly and at reasonable rates.

All this has been accomplished with no job dislocation and with improved working conditions. The industry still has its reputation for offering greater job security than any other industry.

In recent weeks several electrical industry leaders have urged that utility management take the lead in advancing automation. Certainly personal experience in utility operations has equipped management to undertake this task.

ELECTRICAL WEEK



OUTPUT

Week ended April 21
10,894,000,000 Kwhr
Up 12.3%

Atomic Energy Commission requirements — 1,125,000,000 kwhr (Electrical World estimate). Excluding AEC, output increase was 10.3%

Per Cent Change From Previous Year

	Total US	New Eng.	Mid. Atlan.	Cent. Ind.	West Cent.	South-east	South Cent.	Rocky Mount.	Pacific NW	Pacific SW
April 21	+12.3	+13.0	+8.4	+19.0	+10.0	+15.5	+4.9	+10.0	+9.6	+2.9
April 14	+13.7	+12.4	+9.0	+19.7	+10.9	+15.5	+10.7	+13.7	+11.5	+7.6
April 7	+12.6	+14.5	+7.7	+17.3	+9.4	+13.2	+11.3	+11.0	+16.9	+6.6

Seasonally Adjusted Index 214.8 Week Ago 214.6 Year Ago 191.2

Issue's Highlights—Industry urges holding company act revision to speed atomic power development through pooling arrangements . . . AEC's Roddis compares small, large reactor costs . . . AEC reports series of transformer failures at its Portsmouth facility . . . Status of current legislation affecting utilities shown in chart . . . Outlook for utility money costs analyzed . . . CIGRE Paris meeting program outlined.

Removal of Two TVA Directors Urged—Hamilton County Republican Executive Committee has urged removal of TVA Directors Dr Raymond Paty and Dr Harry Curtis, both Democratic administration appointees, for "contumacy." The request, in resolution form sent President Eisenhower, blasted TVA "political activity," deplored the pair's "expressed contempt" for policies of Congress and the executive.

Highlights of Public Power Meeting—Federal government can, and should, undertake vigorous atomic power program by construction of large-scale reactors in six U. S. locations, said Sen Albert Gore (D-Tenn.), at American Public Power Assn convention, Los Angeles . . . APPA Pres W. E. Hooper charged, "Private power people have it figured that anything that affects their supposed right, either as to territory or rates, is called socialism." He added, "Atomic power development is suffering because of this philosophy."

Full-scale demonstration reactors built by government would provide yardstick measurement of construction, operating costs of nuclear power plants, NRECA Pres J. E. Smith told delegates . . . Alex Radin, APPA general manager, urged, "We must continue the fight for adequate revenue bond legislation for TVA, full . . . development of Hells Canyon, and to secure legislation for development of Niagara Falls by the New York State Power Authority."

NEWS OF THE INDUSTRY BRIEFLY TOLD

Washington Wire—House-Senate conference met but failed to agree on TVA's $3.5-million appropriation request for start of additional 180,000-kw Sevier Steam Plant unit. Senate has ok'd appropriation, but House voted instead to let TVA apply power revenues to the purchase . . . Congress passed bill authorizing $295.5-million AEC construction program in fiscal 1957. Funds must yet be voted . . . National Hells Canyon Association has filed with FPC to block Idaho Power's preliminary financing for three-dam Snake River hydro project.

Foreign Wire—One reactor of world's first full-scale atomic power station of Britain's Atomic Energy Authority at Calder Hall is ready for fuel-loading. AEA expects shortly to make the reactor "critical" by starting fission of uranium fuel. When completed later this year, station will operate at 92,000 kw and will be officially opened on Oct. 17.

Lord Citrine, chairman of Britain's Central Electricity Authority, and 18 other officials are paying a return visit to Russia for three weeks to look over power plants. These men were hosts to Soviet Power Minister Georgi Malenkov during his visit to Britain.

Westinghouse Scores High in First Quarter—Despite strike, Westinghouse shipped $225.4-million worth of products in first quarter of 1956. They have booked more orders than 1954's first quarter which was third highest in any quarter, Pres Gwilym A. Price told New York directors meeting last week. "Our problem now in the heavy apparatus end of our business is one of bringing our production up to delivery requirements. This is being done as rapidly as possible (EW, April 16, p 80)."

Municipal Elections—Morton, Ill., citizens voted 794 to 234 to approve action of Village Board to sell its generating and distributing system to Central Illinois Light for around $950,000. Sale includes 35-year franchise . . . Newton, Miss., voters (314 to 167) favored Mississippi Power getting new 25-year franchise. Action followed another ballot conducted last summer in which voters turned down a proposed $775,000 bond issue to build city-owned plant and system.

ABOUT PEOPLE IN THE INDUSTRY

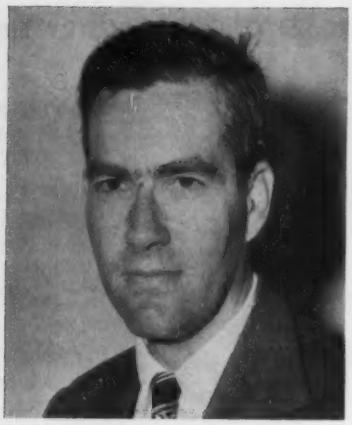
The "product (electricity) we are selling is the super-product," American G&E Pres Philip Sporn told annual meeting. Its ability to perform every task better than any competing form of energy will help it to overcome such difficulties as "large amount of capital necessary to produce dollar of revenue, robustness of competition including threats of federal and other government competition, tightest kind of regulation. . . ."

"A real demonstration of how American enterprises can work together" was Southern Indiana G&E Pres A. B. Brown's view of its power agreement with Alcoa's $80-million smelter plant to be built in Evansville, Ind. The utility will supply interim construction power, then operate Alcoa's steam plant. "It is a demonstration of the working of that term we hear so often, 'free enterprise.' We are proud to be a part of it."

More News About People page 152

Detroit Edison's Cisler,

Montana Power's Corette,



SEC's Armstrong . . .

Debate future of A-power development as . . .

Industry Urges Holding Co Act Revision

Whether or not the future of atomic power development in the U. S. is to be handicapped by legislation designed for a pre-atomic age was being debated in Congress last week.

At the root of this is Utilities Holding Company Act of 1935. One of the provisions of that act requires federal registration—and strict supervision—of operating electric utility companies that join with others in establishing subsidiary firms to produce electric energy.

No operating utility wants to take on the headaches of such regulation. But many, already deep in the atomic research program, find they cannot afford to plunge into full-scale nuclear powerplant construction ventures without the aid of other utilities.

A solution, of course, would be exemption from the holding company act's limitations. Last week, they asked a Senate subcommittee to take the first step toward granting this.

Agency Heads Favor Exemption

They had with them representatives of two powerful independent government agencies—Chairman Jerome K. Kuykendall of the Federal Power Commission, and Acting Chairman Willard F. Libby of the Atomic Energy Commission. These two officials and their aides saw no reason to deny a blanket exemption.

There was opposition. The public power bloc, represented by the American Public Power Association and Democratic Sen Wayne Morse of Oregon, warned that the proposal was engineered not for the advancement of the atomic power program, but to give advantage to private utilities. On their side, technically at least, was J. Sinclair Armstrong, chairman of the Securities & Exchange Commission, who expressed fears that the exemption would remove SEC's discretionary authority.

Industry Views Presented

But these fears were rebutted by spokesmen for the private utilities. Walker L. Cisler, president of Detroit Edison Co and head of one of the biggest pooled ventures in the atomic power field, Power Reactor Development Co, pointed out that state regulatory bodies and the FPC provide sufficient protection against possible abuses under an automatic holding company act exemption. And, he added, unless an automatic exemption is granted, the atomic power development program would be slowed to a crawl.

Armstrong and the public power witnesses testified there was no need for a blanket exemption at this time because SEC can, under the holding company act, grant individual exemptions at its discretion. But Cisler and others pointed out the limitations of this: SEC can summarily withdraw any exemption it has granted, or require repetitive establishment of reasons for continuing an exemption, after large sums of money have been invested by sponsoring companies.

And, said Cisler:

- An act of Congress effecting a blanket exemption cannot be changed so arbitrarily.
- An exemption would not do violence to the holding company law, or remove from SEC jurisdiction any companies now required to register.
- Application of the holding company act to nuclear development pools does not comport with the original intent of Congress.

A-power Progress Cited

Libby and AEC General Counsel William Mitchell endorsed Cisler's stand. Mitchell pointed out, too, that nuclear pools were set up originally to spread speculative costs, tort liability and insurance risks, and speed organization of an infant industry still in experimental stages.

Turning to one of the broader provisions of the pending legislation, Kuykendall and John E. Corette, president of Montana Power Co, and vice president of Pacific Northwest Power Co, testified as to the advantages of a blanket exemption for joint ventures in the steam and hydroelectric fields.

Kuykendall said FPC favors the exemption for steam and hydro. He limited his testimony chiefly to these topics, since FPC now has no clear

authority over atomic power projects.

"Legislation which would facilitate joining of two or more electric utility operating companies through a jointly-operated subsidiary to construct waterpower projects of larger size than would be possible for any such companies to construct acting singly, where such projects are subject to licensing by FPC, would be a highly desirable step," said Kuykendall.

Corette is an official of the subsidiary company which wants to develop Mountain Sheep-Pleasant Valley. He testified that Pacific Northwest Power consumers would save $6 million a year, through a reduction from 5 to 3.5 mills per kwhr in sponsoring company rates, if Pacific Northwest Power Co is permitted to build the project without restrictions.

Eugene S. Loughlin, chairman of the Connecticut Public Utilities Commission; Alan W. Hastings, Gulf States Utilities Co of Texas, and Robert E. Ginna, executive vice president of Rochester Gas & Electric Co, and a director of Atomic Power Development Associates, testified in the same vein.

Act Would Cover Manufacturer

To illustrate the far-reaching effects of the present law in areas where Congress obviously had no intention of requiring regulation, George M. Holley, Jr, president of Holley Carburetor Co, pointed out that his company would have to register as a holding company if it continues to participate in atomic aircraft plans.

How far the bill will get through the congressional mill remains to be seen. As evidenced in the subcommittee hearings, there is sizeable support for its passage, and some opposition based on considerations which actually go far beyond its purpose.

However, despite the favorable attitude of the subcommittee toward the legislation—chairman is Sen John O. Pastore (D-R.I.), sponsor of the bill—it is known that the Senate Democratic majority is not inclined to push it through this session; the feeling seems to be that election year is not a good time to approve a blanket exemption to any statute which regulates a segment of business.

Chances are the bill will be approved by the subcommittee, and maybe even by the full Senate Interstate Commerce Committee. But then, observers believe, the Senate will not act this year.

Reactor Size Not Allied to Cost

. . . says AEC's Roddis, who estimates per kw outlay of small reactors will match that of largest atomic plants designed

The Atomic Energy Commission expects the seven small nuclear reactors proposed under its second-round power demonstration reactor program to match per-kw costs of the biggest atomic power plants.

This was disclosed by Louis H. Roddis, deputy director of AEC's Reactor Development Division, in a discussion recently before the American Public Power Association in Los Angeles.

For the purpose of making his comparison, Roddis expressed all costs in dollars per kw of installed capacity; assuming that all fuel, operation, and maintenance costs for a 30-year plant life were paid along with construction costs at the beginning of plant operation. Here's what he arrived at:

- Cumulative costs of $700 per kw for large steam plants averaging 224,000 kw in four turbogenerator units; $1200 per kw for small steam plant of 36,000 kw in four units; $1700 per kw for diesel plants of 4,500 kw in four units.
- Range for nuclear power plants proposed by the first- and second-round demonstration reactor designers is $220 to $960 per kw.

Roddis' comparison of per-kw costs of every power reactor proposed for construction at the present time is shown below.

Roddis was speaking to owners of small power plants. So he concentrated on their needs, ruling out on the basis of AEC's experience three types of reactors better as large plants.

In the first place, he said the fast breeder—planned by Detroit Edison and associates—will not lend itself to small station requirements because it requires too much enriched uranium or plutonium fuel inventory. This means it would have to operate at very high load factors over its entire life span.

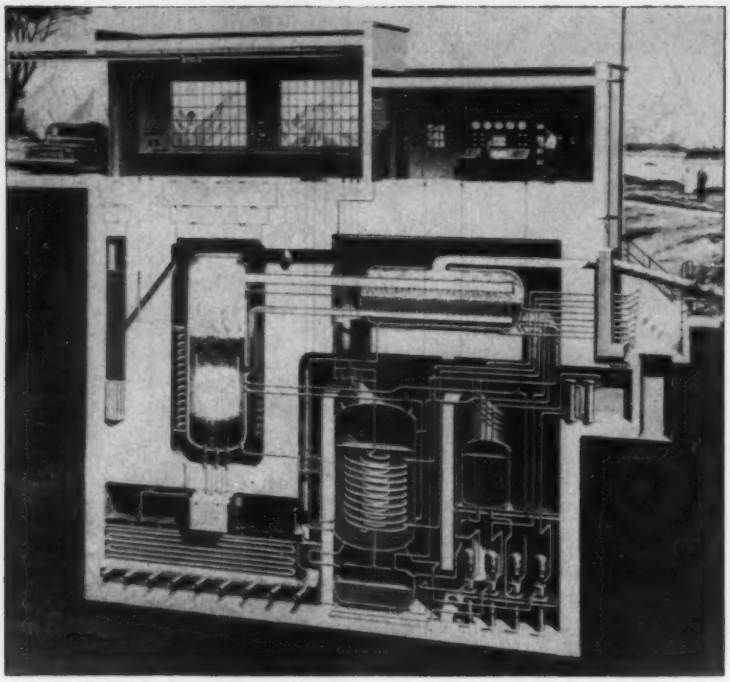
The natural uranium, graphite-moderated, gas-cooled reactor, such as those at Oak Ridge and Brookhaven National Laboratories, and the natural uranium, graphite-moderated, water-cooled reactor used for plutonium production at Hanford require less enrichment, but they are large and require high initial cost.

In presenting his cost figures to the APPA convention, Roddis said:

- The estimates are all tentative, since no power reactor has actually been operated to judge its economy. "The biggest unknowns are in the region of operating costs."
- "The type of reactor is less important in cost estimating than is the person doing the estimating."
- Nuclear plant development is now bringing the first costs of these plants near the point at which they will be allowable in a competitive installation.

Plant	Type	Capacity (kw)	Cost
Consolidated Edison	PWR	250,000*	$220
Commonwealth Edison	Boiling Water	180,000	280
Yankee Atomic Electric	PWR	134,000	257
Power Reactor Dev. Co.	Fast Breeder	100,000	540
Consumers Public Power Dist.	Sodium Graphite	75,000	364
Duquesne-AEC (Shippingport)	PWR	60,000**	792
Orlando, Fla.	Liquid Metal Fueled	25–40,000	512
Elk River Co-op.	Closed Cycle	22,000	281
Holyoke, Mass.	Gas Turbine	15,000	429
Piqua, Ohio	Organic Moderated	12,500	424
Wolverine Electric Co-op.	Homogeneous	10,000	357
Chugach Electric Assn.	Sodium Cooled	10,000	735
University of Florida	PWR	2,000	800
AEC Experiments:			
Sodium		7,500	708
Homogeneous		4,000	450
PWR (Army Package Plant)		2,000	960

*Including 110,000 kw from oil fired superheater
**Capacity range from 60,000 kw with first fuel load, to eventual 100,000 kw



AEC Okays Elk River Atomic Reactor

Construction of a 22,000-kw closed-cycle boiling water reactor for the Rural Cooperative Power Association of Elk River, Minn., has received basic approval by Atomic Energy Commission.

The $10-million atomic reactor (above), will be built by AMF Atomics, Inc, a subsidiary of American Machine & Foundry Co, and will produce electric power at a cost of less than eight mills per kwhr, one mill per kwhr less than RCPA's current generation cost. Construction is expected to begin within 18 months, following completion of negotiations.

AEC said the negotiations "will determine the kind of assistance to be given the cooperatives and will establish the cost limits of this assistance." RCPA has proposed that it assume capital costs totaling $2,450,000 and has requested a loan of $2,980,000 from Rural Electrification Administration. Under the proposal, AEC would contribute a maximum of $6,860,000 and would retain title to the reactor with RCPA providing the electrical portion of the plant.

Vote Set on Highway Relocation Bill

The House prepared to vote last week on the highway program. The bill calls for a 13-year construction program costing an estimated $51.5 billion—federal share would run about $36.7 billion, and a 16-year pay-as-you-go taxing program designed to bring in $38.5 billion from new and existing user taxes—plus increases.

Under the bill, the federal government will reimburse states that pay for relocating utilities on the same matching basis as is being done for the project under construction, 90-10 on interstate roads, including extensions within urban areas, and 50-50 on others.

"Cost of relocation" includes the entire amount paid by a company to relocate a utility, less any increase in value of the new facility and any salvage value from old facility.

There is no ceiling put on utility relocation costs; previous thinking had been to limit such costs to 2% of the cost of the project under construction.

Atom Exchange . . .

on world basis nears as International Atomic Energy Agency agrees on draft statute

The International Atomic Energy Agency proposed by President Eisenhower in December 1953 moved a long step towards becoming a reality. A 12 nation drafting committee which has been meeting in Washington for nearly two months reached unanimous agreement on a draft statute.

The Russians, who had been expected to throw monkey wrenches, accepted the main lines of the western proposals without quibbling beyond a pro forma bid for inclusion of Red China—upon which they did not insist.

The draft provides for an agency very close to the original Eisenhower concept. The agency is designed to become the main channel for international cooperation in peaceful atomic development. If the Russians continue to cooperate it would become a new door to peace through which east and west could exchange nuclear materials, technical information, scientific knowledge, and atomic technicians. In time it could lead to significant diversion of fissionable materials to peaceful uses.

Agency's Functions

The proposed agency would have the following functions and powers:

- It would act as a broker and eventually a bank for supplying fissionable materials to have-not nations.
- It would recruit an international technical staff to evaluate peaceful atomic projects for which its assistance would be asked.
- It would act as an international clearing house for atomic information and technicians.
- It would recruit an international corps of inspectors to police its projects against diversions of materials to military uses.

The draft statute now will be submitted for final approval to a conference of the 84 member nations of the United Nations and its specialized agencies to be held next September in New York. All of these countries are eligible for membership, but the agency would begin to function when 18 of them had ratified the statute. U. S. officials hope that this goal may be reached by the summer of 1957.

330-Kv Transformers Fail

Three 100,000 kva, three-phase units returned to manufacturers for repairs and analysis from AEC's Portsmouth project

Officials of the Atomic Energy Commission's Portsmouth (Ohio) Area Project have disclosed to Electrical World that three 100,000 kva 330-13.8 kv 3-phase power transformers supplied by two manufacturers were returned to their makers as a result of a series of transformer failures extending over a period of several weeks. Two of the transformers were supplied by General Electric Co and one by Pennsylvania Transformer Co.

A Pennsylvania Transformer Co spokesman told Electrical World that his company's unit was repaired and returned to service early last month after a 7-week period in the Canonsburg, Pa. shops. He said that as a result of a manufacturing defect, a fault originated in the static shield on the ground end. It communicated to the first high-voltage coil. The resulting fault current relayed the transformer off the line. There was no explosion or fire associated with the fault.

Failure Analyzed

It was pointed out that the defect in the static shield was not one associated with voltage or voltage gradient but was due to heat caused by stray flux in the static shield. The transformer that failed is the first of two identical units to be built by the company for the Portsmouth Area of AEC. Design of the static shield of the second unit has been modified to prevent the possibility of a recurrence of this type of trouble, the spokesman said.

The two General Electric transformers involved were also rated 100,000 kva 330-13.8 kv, 3-phase. They were among eight identical units furnished to the Portsmouth Project by GE. At least one of the two transformers was said to have been involved in a fault culminating in a transformer fire that was extinguished by the associated deluge system.

A GE spokesman confirmed the fact that two units of this size and rating are being repaired in the company's Pittsfield, Mass., shops. But he said that the primary source of the failure was not directly associated with the high voltage windings. The units have undergone most painstaking study, he said, and the results are still being evaluated. As soon as the evaluation is complete, a full report will be made, first to the customer and subsequently to the technical press.

The faults involving the two GE transformers occurred subsequently to that involving the Pennsylvania Transformer Co unit.

AEC officials at the Portsmouth project said no curtailment of load has been necessary as a result of the transformer failures. By using reserve busses and by paralleling other transformers on the reserve bus, they said, it has been possible to maintain project load by operating transformers in accordance with their temperature characteristics.

The load of about 1.8 million kw for the project is supplied by Ohio Valley Electric Corp over four 330-kv double-circuit transmission lines (see p 66 this issue).

Utility May Buy Municipal

Carolina Power & Light Co is seeking utilities commission approval to purchase the Grimesland (N. C.) Municipal Power System. The purchase was sanctioned by town voters in an election last November. CP&L estimates that about 600 customers involved will save $12,000 a year under new rates.

Utility Money Cost Outlook: Up

The next few months bid fair to represent a season of perplexity for electric utilities planning issues of senior securities. Shall they proceed to raise money in accordance with their near future needs and budget requirements or postpone action to see whether bond prices will recover from their recent slide?

Last October, and again in January, when money market outlook for electric utilities was discussed (EW, 10/31/55 p 52 and 1/9 p 151), it was indicated that the way of wisdom lay in proceeding to sell as promptly as possible any senior securities where the funds were needed within the ensuing six months or so. Now, after a rise of nearly 0.50% per annum in the yields for A-rated electric utility bonds within the last six weeks, from 3.35% or below to over 3.80%, it's more difficult to picture what the near term future may hold for long-term utility bond yields.

An unusually heavy total of senior offerings in the last 30 days no doubt contributed to the debacle in bond prices. Nor is home building slackening as seemed likely late last year. Institutional funds continue to be ploughed heavily into these channels where higher interest is obtainable.

Short term money rates have firmed too, with rates for brokers' loans increasing and U. S. treasury bill rates at around 2.79%, highest since 1933. The Federal Reserve Banks have again increased their rediscount rates. Some

(*Continued on page* 168)

Public Offering—Electric Utility Securities
(Thousands of Dollars)

	First Quarter of 1956			First Quarter of 1955		
	New Money	Other	Total	New Money	Other	Total
Bonds, Notes, and Debentures	142,000	.....	142,000	210,204	72,796	283,000
Preferred Stocks	61,227	.....	61,227	30,867	9,817	40,684
Common Stocks	45,398	.....	45,398	102,553	.....	102,553
Total	248,625	.....	248,625	343,624	82,613	426,237

Source: Reis & Chandler, Inc.
Note—Debt issues are shown at principal amount and stocks at price to public.

Congressional Scoreboard for Utilities

Identification	Explanation	Status
GOVERNMENT POWER AGENCIES:		
TVA Financing		
HR-6575 (Davis: D-Tenn.) HR-6576 (Jones: D-Ala.)	Permit issuance of 50-year bonds for new construction; bonds secured by power revenues; let Treasury buy bonds. TVA endorsed.	Introduced in House
S-2373 (Kerr: D-Okla.)	Similar to above but no Treasury bond purchase.	Hearings held in Senate Subcommittee
HR-6770 (Buckley: D-N.Y.)	Budget Bureau's version, backed by Eisenhower; requires Budget Bureau and Congressional approval of use of bond proceeds; limits bonds outstanding to $750 million; no Treasury purchases.	Introduced in House
TVA Financing		
HR-10004	TVA request for $3.5-million appropriation to order equipment for 180,000-kw unit at John Sevier Steam Plant, contained in second supplemental appropriations request for fiscal 1956.	Bill in conference. Senate approved TVA appropriations request, but House denied new money, instead directing TVA to use power revenues to pay for new unit. Compromise must be worked out before final action can be completed.
TVA Power Sales		
HR-417 (Dondero: R-Mich.)	Ends TVA's control of local resale rates and sole supplier clause in TVA sales contracts.	Introduced in House
Missouri Valley Authority		
HR-2687 (Wier: D-Minn.)	Creates authority to draw up unified valley development plan; transfers Ft. Peck Dam to MVA; permits president to transfer others.	Introduced in House
SPA Rate Hike		
S-3338 (Kerr: D-Okla. and 15 others) HR-9664 (Trimble: D-Ark.) HR-9721 (Albert: D-Okla.)	All three bills prevent rise in Southwestern Power Administration rates for 18 months. Interior Department withheld application to Federal Power Commission for 40% increase at Senate committee's request.	Senate passed amended Kerr bill to prohibit increases in government power rates until July 1, 1957, except for contracts made prior to Feb. 28, 1957. House bills introduced.
HYDRO ELECTRIC PROJECTS:		
Niagara Development		
S-1823 (Lehman: D-N.Y.)	Directs FPC to license N.Y. State Power Authority to develop hydro power, with federal preference provisions.	Reported by Senate Public Works Committee; cleared by Senate majority policy committee for floor debate.
S-6 (Capehart: R-Ind.)	Provides development by five private utilities under a license.	Rejected by Senate Public Works Committee
HR-5706 (Buckley: D-N.Y.)	Provides New York State Power Authority development under federal license with preference.	Subcommittee hearings held
HR-5878 (Davidson: D-N.Y.) HR-8109 (Buckley: D-N.Y.)	Duplicate of Lehman bill for state development.	Subcommittee hearings held
HR-142 (Miller: R-N.Y.) HR-420 (Dondero: R-Mich.)	Provides development by five private utilities.	Subcommittee hearings held
HR-5377 (Radwan: R-N.Y.)	Provides Army Corps of Engineers construction leaving question of ownership and disposition of power to Congress.	Subcommittee hearings held
Hells Canyon		
S-1333 (Morse: D-Ore. and 29 others) HR-4719 (Pfost: D-Idaho) HR-4730 (Green: D-Ore.) HR-4739 (Magnuson: D-Wash.) HR-4740 (Metcalf: D-Mont.)	Authorize federal construction of single high dam with 800,000-kw; BPA to market power.	Subcommittee approval in both houses
Upper Colorado		
HR-3383 (Aspinall: R-Colo.)	Authorizes $760 million to build Glen Canyon, Flaming Gorge, Navajo and Curecanti reservoirs, plus 12 participating irrigation projects.	President signed bill into law
Fryingpan-Arkansas		
S-300 (Millikin: R-Colo.; Allott: R-Colo.) HR-412 (Chenoweth: R-Colo.)	Authorize federal construction of multi-purpose, 105,000-kw project on Roaring Fork and Fryingpan Rivers in Colorado; repayment in 60 years.	Both bills have been approved by committees
Narrows		
S-2251 (Welker: R-Idaho) HR-6620 (Budge: R-Idaho)	Authorize federal construction on Snake River of 180,000-kw project.	Introduced in House and Senate

Identification	Explanation	Status
John Day Dam		
HR-5789 (Coon: D-Ore.)	Authorize federal construction with six months for local interests to apply for partnership participation in paying $273-million cost of power facilities in return for long-term power contracts. Project on Columbia River, Oregon-Washington border, with 1,105,000-kw planned.	Brief House hearings held, more promised
Libby Dam		
HR-419 (Dondero: R-Mich.)	Rescinds federal authorization for 600,000-kw development on Kootenai River in Montana.	Introduced
Bridge Canyon Dam		
S-403 (Malone: R-Nev.) HR-3148 (Young: R-Nev.)	Authorizes federal construction of 750,000-kw project on Colorado River in Arizona.	Introduced in House and Senate
Tuolumne		
HR-2388 (Engle: D-Calif.)	Authorizes Tuolumne County Water District No. 2 to build and operate 70,000-kw hydro project on Tuolumne River below Hetch Hetchy reservoir, with provision prohibiting sale or lease of power rights except to California public agencies.	House hearings held
Oroville		
HR-462 and HJ-Res-462 (Engle: D-Calif.)	Provides $100-million federal contribution to California which has been authorized to build this 465,000-kw project on Feather River as part of Central Valley Project.	Introduced in House
Cougar-Green Peter-White Bridge		
HR-4662 (Ellsworth: R-Ore.)	Provides for partnership construction of power facilities; City of Eugene, Ore., would finance 25,000-kw power at Cougar; private utilities would finance 82,000-kw total at Green Peter and White Bridge.	House public works subcommittee held hearings
OTHER LEGISLATION		
Holding Company Act		
HR-6294 (Dodd: R-Conn.) HR-7258 (Thompson: R-Mich.) HR-7554 (Hayworth: D-Mich.) S-2643 (Potter: R-Mich.)	Amend act of 1935 by removing technical provisions from act which are obstructions to companies' team-development of electric energy, particularly atomic power.	Introduced in House and Senate
HR-9743 (Cole: R-N.Y.) S-2643 (Pastore: D-R.I.)	Amend act of 1935 permitting joint sponsorship of atomic power ventures without necessity of registration as holding companies unless already subject to the act.	House bill introduced. Senate subcommittee held hearings on Pastore bill but Senate leadership sees little chance of Senate passage this year.
Kwhr Tax		
HR-5694 (Mason: R-Ill.)	Levies 5% tax on sales price of manufactured articles, including "electricity, gas, steam, or other forms of energy."	Introduced in House
Downstream Benefit Charges		
S-1574 (Goldwater: R-Ariz.)	Authorizes Interior to make annual payments for power benefits received by downstream federal projects from upstream non-federal.	Senate subcommittee approved bill
Highway Relocation		
S-1048 (Gore: D-Tenn.)	Provision in highway bill for payment of half the costs of relocating utility facilities, limited to 2% of each state's allotment.	Passed by Senate
HR-10660 (Fallon: D-Md.)	Provision in federal highway bill for reimbursing states who pay utilities for costs of relocating facilities because of highway building.	House Public Works Committee approved provision authorizing federal payment of relocating utilities facilities in same way as federal funds are spent.
Atomic Insurance		
HR-9710 (Price: D-Ill.)	Authorizes federal indemnity of liability at private nuclear power plants for amounts exceeding insurance coverage available from private carriers at reasonable rates. A 10-year limitation is included. Private carriers have indicated they will underwrite up to $60 million in liability risks at each facility.	Introduced. Joint Congressional Atomic Energy Committee held two-day seminar with private individuals to discuss the insurance problem. Action is promised soon.
HR-9802 (Cole: R-N.Y.)	Limits nuclear reactor owners' and manufacturers' liability to twice the capital investment in a plant.	Introduced
Federal Atom Power		
S-1049 (Gore: D-Tenn. and Monroney: D-Okla.)	Authorize appropriation of money for experimental nuclear facilities to demonstrate practical value.	Introduced in Senate
S-2725 (Gore: D-Tenn.)	Directs AEC to build 6 plants of different design for same purpose.	Introduced in Senate

To Get 'Elbow Room' . . .

West Penn Power

• New Cabin Hill headquarters building is located on 20-acre site near Greensburg, Pa.

MAIN LOBBY entrance is bright, spacious, and cheerful. Indoor planting contributes touch of outdoor, park-like setting to Cabin Hill. Mural decoration, above receptionist's desk expresses 'more power' theme

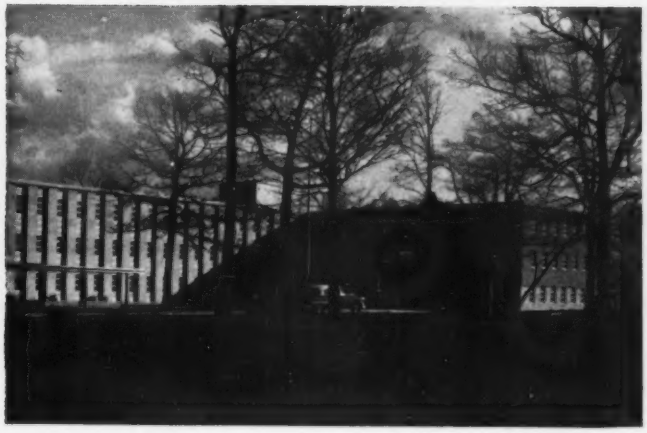
CAFETERIA is provided with picturesque view through glass window-wall, helping to make lunchtime a pleasant interlude. Also available is attractive dining room for special luncheon and dinners

PRES P. H. POWERS chats with guest in his office. Good lighting, colorful decorations give room warm and home-like atmosphere. Drape-covered windows look out on landscaped building approach

Moves to Country

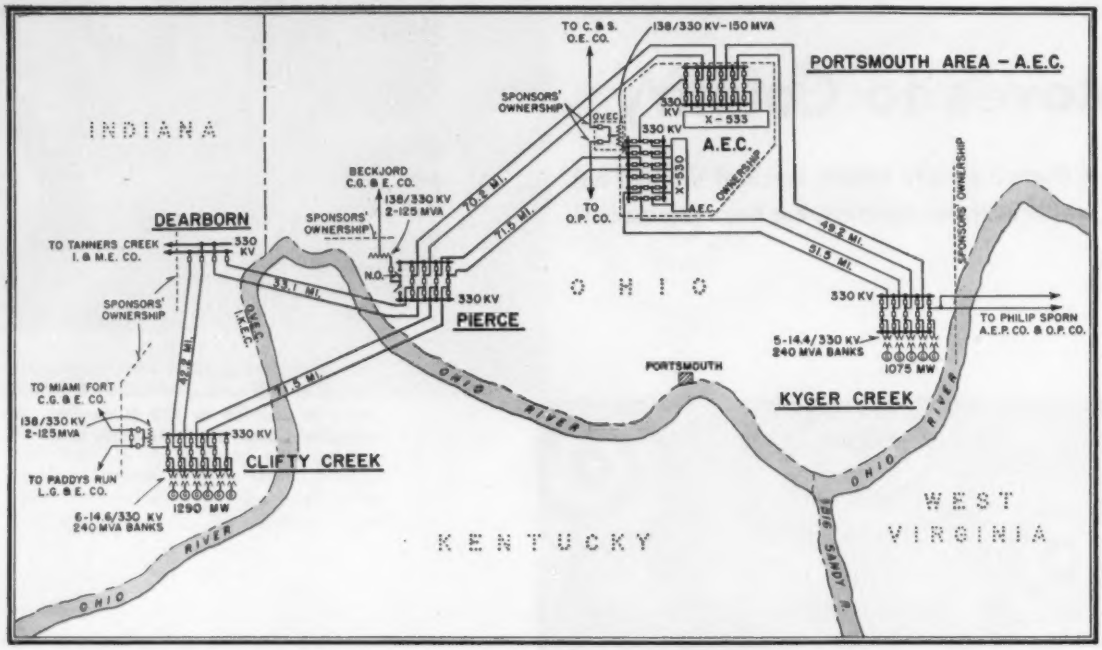
- Once a private estate, much of original natural beauty, landscaping, has been retained

IN DRAFTING ROOM and other areas where critical seeing is involved, lighting level is doubled to 130 ft candles. Acoustical baffles cut down noise level



HOME SERVICE test kitchen is really four kitchens in one, plus a laundry area. It combines newest electric appliances with gay color schemes and accessories. Note excellent lighting, accoustical baffles

SPECIAL DISPLAYS are designed and produced here by West Penn's own well-equipped Display Department. They go out to dealers, district offices or to general office for various display uses



OVEC-IKEC GENERATION AND TRANSMISSION FACILITIES consist essentially of . . .

. . . 1. Two generating stations, Clifty Creek near Madison, Indiana, and Kyger Creek near Galliapolis, Ohio

. . . 2. Two double-circuit 330-kv transmission lines from each station to the Portsmouth Area Project of AEC

. . . 3. Intermediate switching stations at Dearborn and Pierce

OVEC-IKEC system interconnects with the systems of the participating companies at 330 kv at Dearborn and Kyger Creek, and at 138 kv at Clifty Creek, Pierce, and at the Portsmouth area

Twin 345-Kv Line Carries 1,000 Mw

TRANSMISSION
Operation

OVEC transmission link makes history by carrying record load for almost a week. One circuit was loaded to 725 Mw for 2 min

PHILIP SPORN, President, American Gas & Electric Service Corp, New York, N. Y.

Recent discussions* have emphasized the need to get on with the business of developing and building much higher voltage transmission networks for the power systems of the future. Importance of attaining feasible transmission line loadings of 500 Mw on one circuit of a double-circuit 345-kw transmission line or 1,000 Mw on both circuits was stressed in the light of the coming quadrupling of utility system loads in the United States during the next 20 to 25 years.

Such observations, no matter how well qualified the observer, are likely to miss a great deal their effect because the need for such large transmission capacity is not appreciated. Or, if it is realized, its practical accomplishment is too often questioned.

A recent experience in the operation of Ohio Valley Electric Corp (OVEC) during which a 1,000,000 kw was actually carried on a double-circuit 345-kv line for close to a week throws a new light on both aspects and sharply marks a new milestone in magnitude and effectiveness of high-voltage, high-power transmission.

OVEC was sponsored and organized by 15 private electric companies in Indiana, Kentucky, Ohio, Pennsylvania, and West Virginia for the express purpose of supplying the power requirements of the Portsmouth, Ohio, uranium diffusion plant of the Atomic Energy Commission. The power system of OVEC, designed to carry the 1.8 million-kw initial contract load of the project, comprises the Clifty Creek and Kyger Creek generation stations together with some 390 line miles of double-circuit, extra-high-voltage transmission lines. The system is shown in Fig 1.

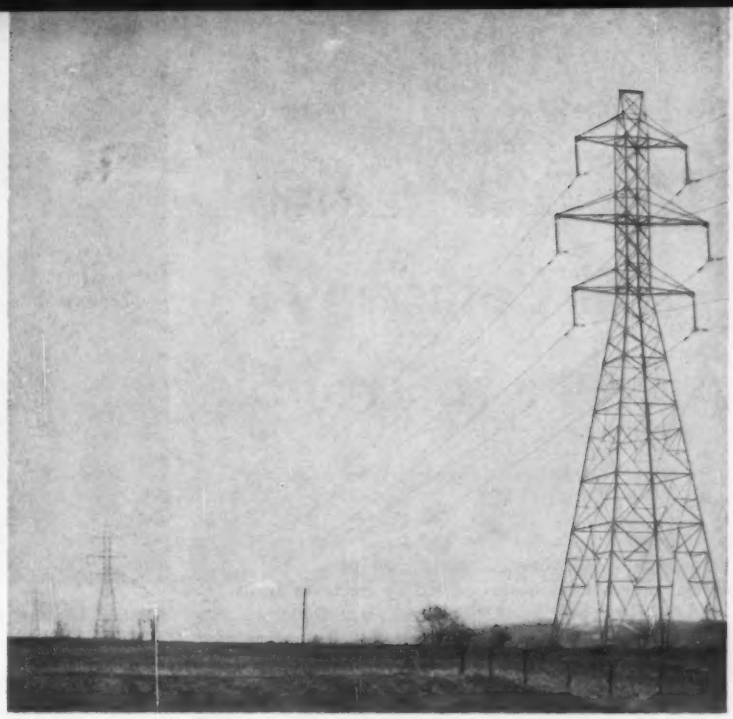
Four double-circuit lines, two from each of the generating stations, which are located respectively to the west

* Footnote: See, for example, "Movement of Power," delivered at EEI annual convention in Los Angeles, June 16, 1955, by Philip Sporn

and to the east of the project, are capable of handling the entire 1.8 million-kw load with any two single-circuit line sections out of service simultaneously. The actual load has been running appreciably in excess of 1.8 million kw. A view of a typical section of line is shown.

During recent storms in Ohio, two of the towers on one of the double-circuit lines from Kyger Creek to the project were wrecked by a direct hit from a tornado, leaving only one line in service. After prearranged dropping by automatic relays of a relatively small portion of the AEC load, conditions were stabilized; and the full AEC load was brought back and carried.

During the close-to-a-week's outage of the damaged line, the project was maintained at full load without any curtailment, and for the greater portion of this time the remaining line from Kyger Creek to the project carried in excess of 1 million kw.



1,000 MW WAS CARRIED over the six conductors of this Kyger Creek X-533 North 345 kv line of OVEC for nearly a week. Conductors of the two circuits are expanded ACSR of 1.75 in diameter with 1,414,000 circ mil cross section

Record Load Carried

While this loading is well within the predicted capability of the circuits and the outage of any two circuits simultaneously was a specific design criterion, nevertheless this is believed to be the first time in the history of electric power transmission that more than 1 million kw has been carried on one double-circuit line. During this period, the carrying of this load was facilitated in part by raising the voltage level from about 350 kv to 356 kv at the Clifty Creek Plant bus and from 340 to 346 kv at the Kyger Creek Plant. While these adjustments at the generating stations were sufficient to hold voltage at the load appreciably above minimum operating levels, an additional boost as a safety margin was provided at the project by putting to work the reserve portion of reactive generating capacity of a number of synchronous condensers at the load. No difficulty was experienced in operating at the higher levels at Clifty Creek and Kyger Creek Plants, and, as a matter of fact, these levels have remained in effect following the restoration of the damaged line.

From a single-circuit standpoint an even more spectacular loading was carried for a short time only a few hours after the completion of repairs and return to service of the damaged line. During a period of about two minutes when three of the four circuits feeding the AEC project from Pierce switching station to the west were out of service simultaneously because of storm conditions, the one remaining circuit carried approximately 725,000 kw. As shown in Fig 1, the Pierce switching station is the termination of four circuits from Clifty Creek, two by direct line and two by way of the Dearborn switching station. This in turn is located adjacent to and directly tied in with the Tanners Creek Plant. With this strong back up, the carrying of this unusual load on the one 70-mile circuit from Pierce to the project was facilitated by a fairly high voltage level maintained at Pierce.

In both of these cases high-speed relaying of these extra-high-voltage circuits in conjunction with 3-cycle circuit breakers, representing fault-clearing time of only four cycles, proved its effectiveness in maintaining continuity of a normally rather critical load.

In the first case, even with the extreme severity of a double-circuit, 3-phase fault fairly close to the project, the tripping of the faulted line was fast enough, along with the automatic tripping of a small portion of load, as mentioned above, to prevent the loss of the main project load. For a line length in this case of approximately 50 miles, the loading of 1,000,000 kw on one line or 500,000 kw per circuit representing about 1.7 times surge-impedance loading at 330 kv, is considerably below stability limits. The extreme severity of this occurrence lay in the double-circuit solid 3-phase fault which initiated the trip-out.

On the other hand, the 725,000 kw carried by the single-circuit line in the second instance at a delivered voltage of approximately 320 kv over a 70-mile line is equivalent to about 2.6 times surge-impedance loading at that voltage and is not too far below practical stability limits for that distance. It may also be of interest to point out that this load represented an actual line current of approximately 1,300 amp.

These demonstrated capabilities bring sharply into focus the capacity, flexibility, and inherent ability of extra high voltage networks to reduce transmission costs for the clearly indicated coming of mass generation of electric energy that will confront the electric utility industry in many locations in the United States. If in some cases this will be delayed a bit, no one can doubt that its eventual coming is sure wherever there is a dynamic complex consisting of population, industry, growth, and belief in the future.

New Distribution Is Oil Company's Answer to Trouble

DICK WILLIAMS, Industrial Consultant, Arizona Public Service Co, Phoenix, Ariz.

Producers Cotton Oil Co of Arizona, Phoenix, is saving money today because its modernized plant distribution system prevents shutdowns caused by electrical faults.

In the past permanent faults on plant feeder circuits caused outages of considerable lengths. In cotton seed processing, a power outage of over 10 min duration becomes extremely expensive because it takes 6 to 8 hr to remove the hardened cake from seed compressors. These shutdowns could have been minimized if, at the time of the fault, adequate fuse protection and coordination had been present, thereby isolating the fault and its effects.

These faults also could have caused considerably more damage to the main bus and substation transformers because the main oil circuit breaker was rated at 2,000 amp, although it carried a continuous load of about 2,500. Moreover, this oil circuit breaker could never have handled a main bus short circuit of 43,500 amp. Such a short circuit current could result from a main bus fault of 31,500 amp and a possible motor assist of 12,000 amp.

Arizona Public Service Co was asked by Producers' plant engineer to survey the plant and outline what should be done to prevent recurrences of the outages.

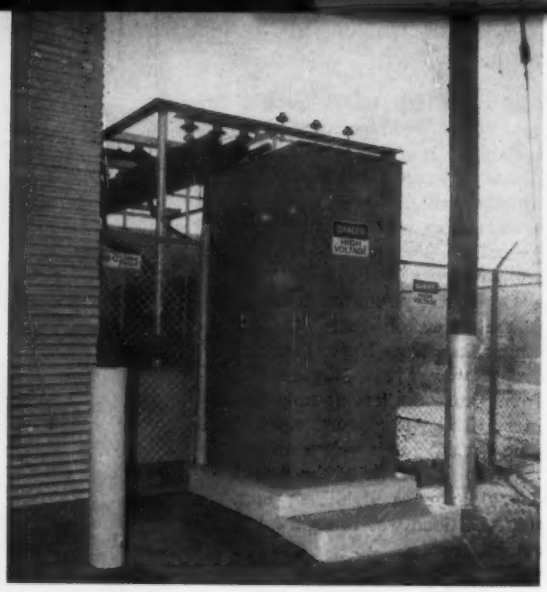
The company processes cotton seeds after ginning. It uses about 3,200 hp to delint seeds and compress oil from them. Around 265 induction motors, ranging from 1 to 125 hp, are applied to delinting and compressing tasks. The total operation requires nearly 30 acres of storage and mill space.

This space was acquired from another manufacturer. After making a few additions and alterations, Producers was able to use the existing electrical system. The result was the scheme shown in the small drawing. Power is provided by Arizona PS at 12,000 v to a 2,500-kva substation where it is stepped down to 480 v.

An electrical survey showed that conductors for the 22 plant circuits were large enough to handle the existing loads. Protection within the plant consisted of fused switches for each motor and a large fused switch or circuit breaker at the load side of each feeder circuit. However, from this point back through each circuit to the 12,000-v fused cut-outs on the primary side of the substation transformers, there was no overload or fault protection. On many occasions the transformer fuse cut-outs opened on plant electrical faults.

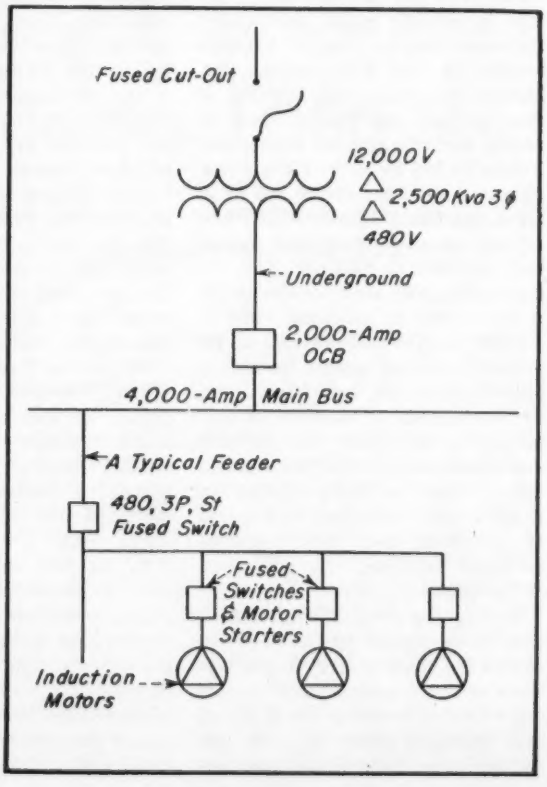
With these large short circuit currents possible, a main breaker was imperative to protect the plant's electrical system from damage. The number and lengths of feeder circuits dictated that groups of these feeders have a circuit breaker at the main bus. This enhanced the electrical system's flexibility by enabling circuit faults to be isolated, and by protecting the system from a short circuit too low in magnitude to trip the main breaker.

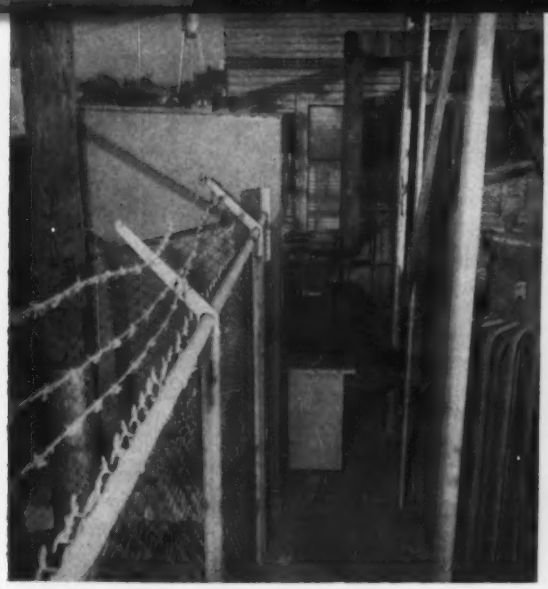
The problem was solved by installing metal-clad, 600-v,



This 4,000-amp circuit breaker . . .

This inadequate distribution system . . .





routes power underground to . . .

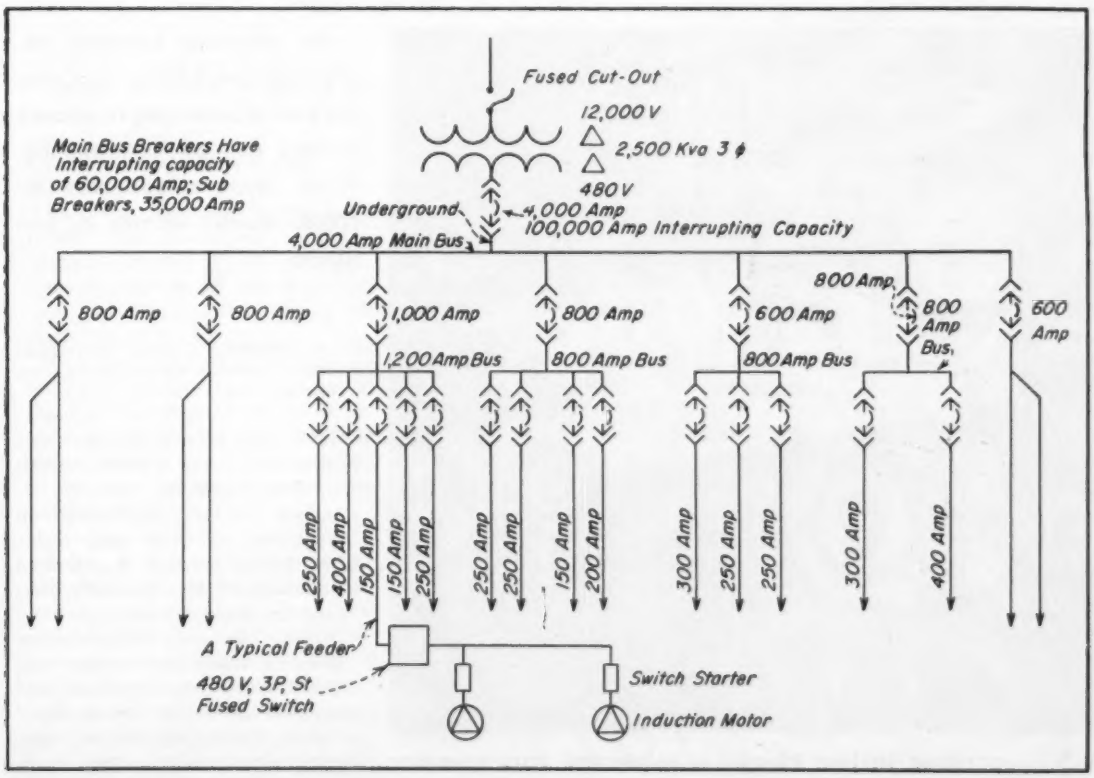
. . . this modern control center

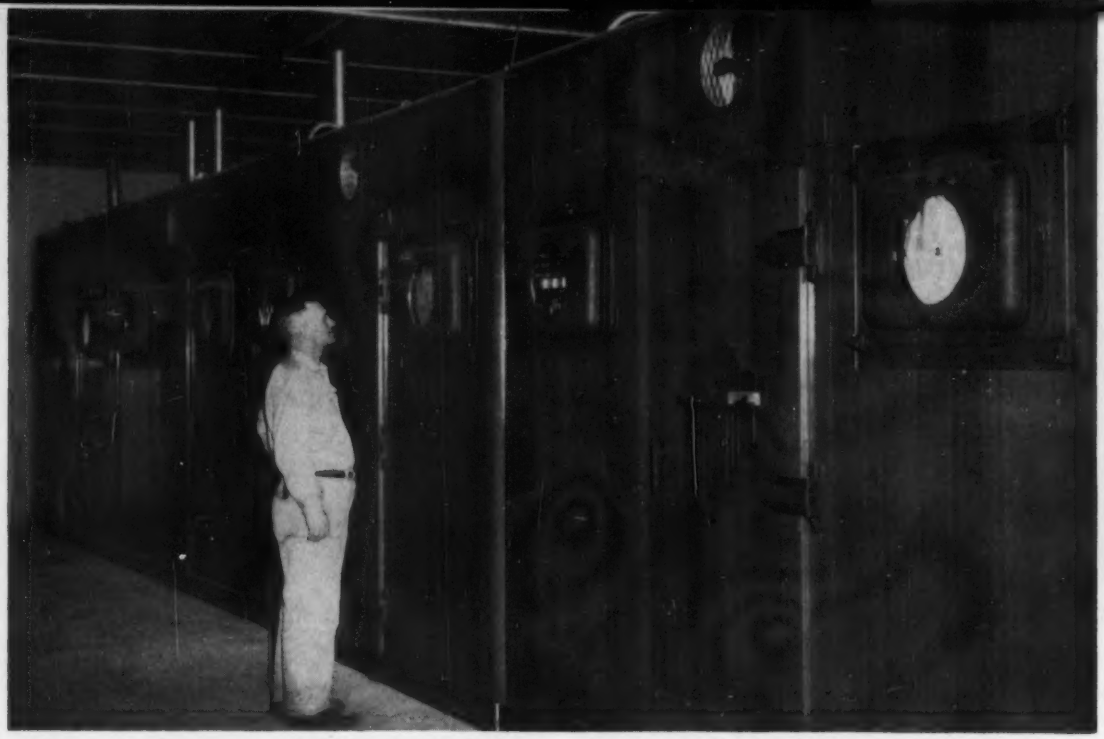
electrically operated air circuit breakers. These breakers are closed electrically by a motor mechanism which charges the closing springs on each breaker.

A 4,000-amp air circuit breaker with an interrupting capacity of 100,000 amp was installed immediately at one end of the 480-v bus at the 12,000/480-v substation. From this main breaker a 100-ft underground feeder runs to a specially constructed building which houses the plant bus and feeder circuit breakers.

The feeder air circuit breakers range in size from 200 to 1,000 amp and have interrupting capacities of 35,000 to 60,000 amp, depending upon the size of circuit load.

. . . was replaced by one which isolates electrical trouble with precision

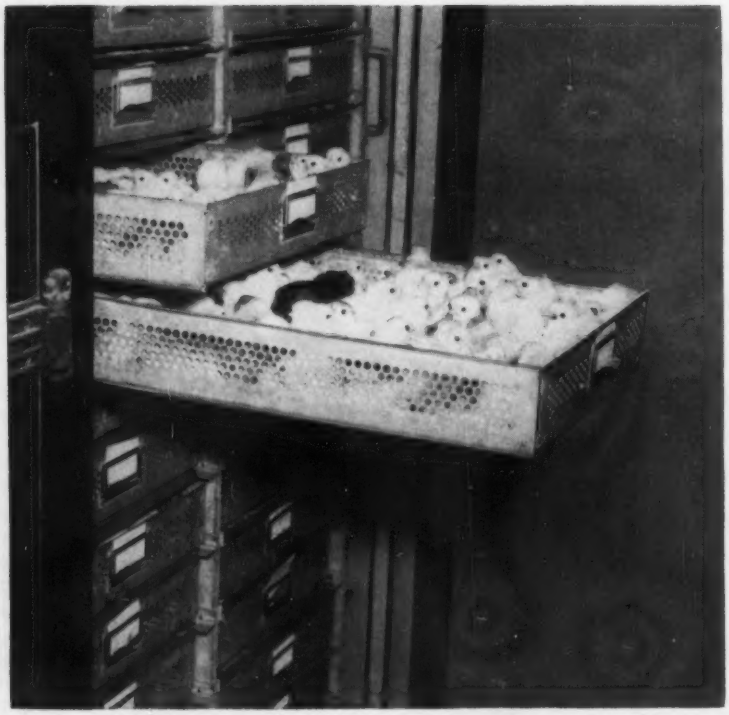




Thousands of eggs hatch in this incubator, held at 99F and 86% humidity, by . . .

INDUSTRIAL Operation

Heat Pump Goes Industrial—



A 5% increase in live chicks is expected this summer

An Alabama hatchery expects to save $350 a year over the cost of operating resistance heaters and air conditioning. Extra chick output may increase annual income by five figures . . .

J. D. BROWN, Electrical Development Branch, Tennessee Valley Authority, Chattanooga, Tenn.

In Bridgeport, Ala., Curtis Allison is pioneering in the hatchery business and saving a good bit of money.

Allison Hatchery, which sends out 75,000 baby chicks a week, is believed the first hatchery in the nation to install electric heat pumps for year-'round air conditioning.

Allison has two 5-hp machines which do a double job—summer cooling and winter heating. These heat pumps operate on the "reverse cycle" principle. During summer they carry heat from the building to the outside.

. . . 5-hp heat pumps which do the job economically

Cuts Hatchery's Costs

In winter, they are automatically reversed to heat the building.

Allison had been considering resistance electric heat and conventional electric air conditioning to do this job. But he put in heat pumps for these reasons:

1. Heat pumps will at least halve heating costs as compared with resistance electric heat. By capitalizing upon heat content of outside air, the heat pump drastically reduces the electricity needed.

This means less wiring because Allison will use only 5-hp machines instead of an estimated 60 kw of resistance electric heat. With the heat pumps, smaller wire will be used and a 200-amp instead of a 400-amp switch box.

2. Although the heat pumps use as much electricity as a regular air conditioning system in the summer, Allison still saves money. These heat pumps use only air and electricity, requiring no water. Therefore a cooling tower, pumps, and a costly annual water consumption of 90,000 gal a year are obviated.

3. Heat pumps switch automatically from heat to cool, and vice versa. Conventional electric heating and air conditioning systems normally require hand switching from one system to the other and drainage of water with the advent of freezing weather. Furthermore heat pumps hold temperature at the desired point every day of the year. This is particularly important during the "in between" weather of spring and fall when heating is needed at night and cooling during the day.

4. Heat pumps supply fresh air constantly—air that is filtered and conditioned. Electric air conditioning would also do this, but conventional electric heating would not. So with the heat pump, Allison's hatchery gets fresh air input, air filtering and air cleaning every day, not merely in summer.

Power Bill to Drop

Allison expects heat pumps to cut his electric bill substantially. They will cost about 40% less to operate than resistance electric heat and conventional electric air conditioning. At an average cost of 1¢ per kwhr, this saving will amount to $350 a year.

Allison believes the installation of year-'round air conditioning will make money for him. For example: He now sets 560 trays of eggs a week, with an average of 156 eggs to a tray. With a mere 5% more chicks per tray during summer months, he will increase his live chicks by about 4,480 a week. And as chicks now sell for 15¢ each, his income will rise by nearly $600 per week during the summer season, or about $12,000 a year.

Spring—All Year 'Round

Successful hatchery operation calls for constant "springtime conditions," Allison says, from the time eggs first enter the hatchery until the day-old chicks are shipped. It takes about three weeks to complete the process of changing an egg into a chick.

The electric heat pumps—by cooling in summer and heating in winter—help at every stage of the hatchery's operation.

After eggs reach the hatchery, the first step is "traying" them. On hot summer days, eggs can be damaged easily by workers who put them by hand into the trays. Exact temperature and humidity control will cut down summertime losses on this egg handling operation and make working conditions more comfortable for employees.

After eggs are trayed, they go into the setting incubator for 18 days. This big machine turns eggs automatically and holds them at 99F with 86% humidity.

The heat pumps—by governing room temperature and humidity—will make it easier for the incubator to do its job. Temperatures and humidity are controlled in the room where the incubator is located so that the incubator will not have to work so hard to overcome changing outside conditions.

Next, eggs are transferred to a hatching incubator, where they remain for about three days. Here again the heat pump will help the incubator to control temperature and humidity. The heat pumps should also help in summertime to cut down on smothering.

Finally, the day-old chicks are packed and shipped. Even while they are waiting to be packed, many chicks are smothered. With controlled temperature in summer, Allison believes he can cut chick losses in this prepacking stage.

Aerial Cable Easily Justified

DISTRIBUTION
Design

Warranted by plant investment of $100 per kva where reduction of losses, and voltage and tree difficulties is evaluated

A. BODICKY, and H. T. FISHER,
Distribution Development Engineer, Distribution Standards Engineer, Union Electric Co of Missouri, St. Louis, Mo.

A plant investment of only $100 per kva justifies a preference for aerial cables over open wire when the normal peak load is near the rating of the overhead open wire, Union Electric Co of Missouri found during a recent study. The utility compared the costs and advantages of the two overhead constructions, the aspects explored including reduced kva losses and voltage drop and tree problems.

It was also found that aerial cable can be justified at even smaller loads when annual tree-trimming costs are very high and outages caused by falling trees are frequent. Studies on individual lines may indicate the advisability of installing aerial cable on a voltage-drop basis alone, even though voltage drop on open-wire lines can be improved somewhat by capacitors or feeder voltage regulators.

In comparing the two constructions costs of a hypothetical mile of circuit of each type were calculated. Four 90-deg corners and five transformer installation were factored in, but not the cost of the transformers themselves. The study revolved around the use of 5-kv aerial cable on the 4,160-v system where such cable can be handled with rubber gloves. The cable was the pre-assembled type, company plans calling for this type until such time as more extensive use of aerial cable will justify the purchase of tools for spinning in the field.

It was assumed that for each kva of energy loss during the normal peak load in the primary distribution feeder, a corresponding increase in capacity is needed in the power plant, sub-transmission, substation, and 4,160-v underground cable. There is about 16% additional loss because of station auxiliaries, transmission, and distribution losses for every kw loss on the distribution system. An additional 4% should be added for

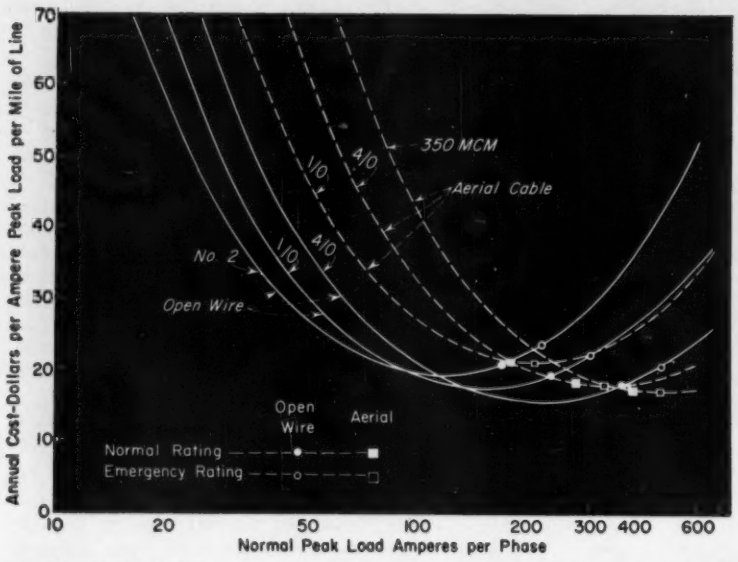


FIG 1—ANNUAL COST per ampere of peak load per mile of line for open wire and aerial cable vs peak load amperes shows economic turning point for each load

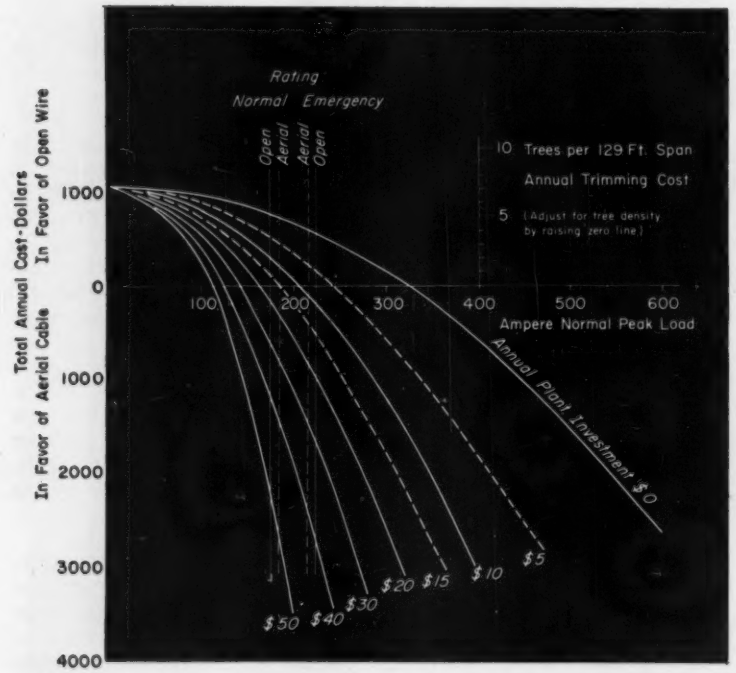


FIG 2—No. 2 OPEN WIRE is compared with 1/0 aerial cable, weighing line costs and costs of plant investment from 0 to $50 per year and also for voltage drop

spare plant capacity on peak load although diversity among feeders may offset this particular capacity requirement.

As a line with feeder regulation is built for maximum load, open wire and aerial cable were compared on the basis of equal emergency rating instead of equal sizes. Total annual cost of either installation is the sum of the cost for capacity requirements, energy loss, and circuit cost. Results based on kw loss alone are similar to those based on the voltage drop. But as there is no difference between open-wire and aerial cable kw loss for the same conductor size, kva loss is more representative of the actual benefit obtained through aerial cables.

Findings based on annual cost per mile of line per amp peak load at $15 annual investment cost are shown in Fig 1. Ampere-miles for 3 and 5% limits of voltage drop at 90% power factor are shown in Table III. Installation of capacitors improves voltage drop and helps to offset the effect of reactance in the open-wire circuit. The maximum number of capacitors—3.18 kvar per ampere-mile—to increase the power factor from 90 to 100% on open wire, reduces voltage drop and increases the transmission distance over which the load can be served. Feeder voltage regulators may be an alternative.

Adjust to Tree Scale

The most economical circuit can be determined from Fig 2, 3, and 4, comparing the annual operating and investment costs for equivalent rated aerial cable and open wire. When the number of trees per span is known, these curves can be adjusted to the tree scale by raising the zero line.

On the basis of $15 annual plant investment cost, the most economical operation of an open-wire line is obtained when the normal peak load is about 65% of its rating. On the other hand, the most economical loading of aerial cable occurs when the normal peak load is about 16% above its normal rating or near its emergency rating. Because of the small range of its economical loading, 1/0 open wire can't be justified.

Voltage drop along aerial cable is 43 to 57% of that of the equivalent rated open-wire construction. Thus, for the same voltage drop, aerial cable transmits the same energy 1.8 to 2.33 times farther than open wire. Use of aerial cable improves the

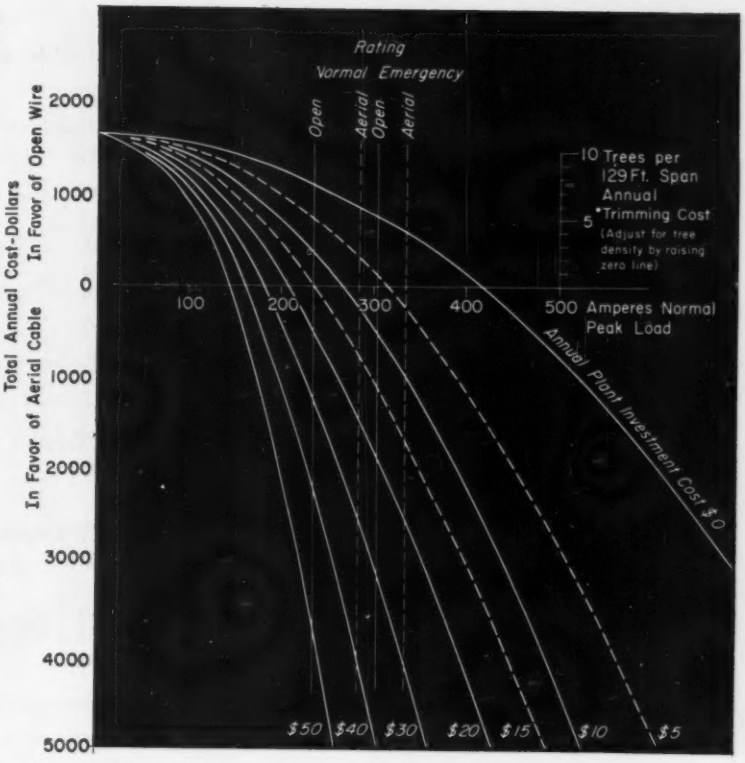


FIG 3—ECONOMICAL TYPE of line can be determined from comparison of 4/0 open wire and 350-MCM aerial cable on basis of costs and the voltage drop

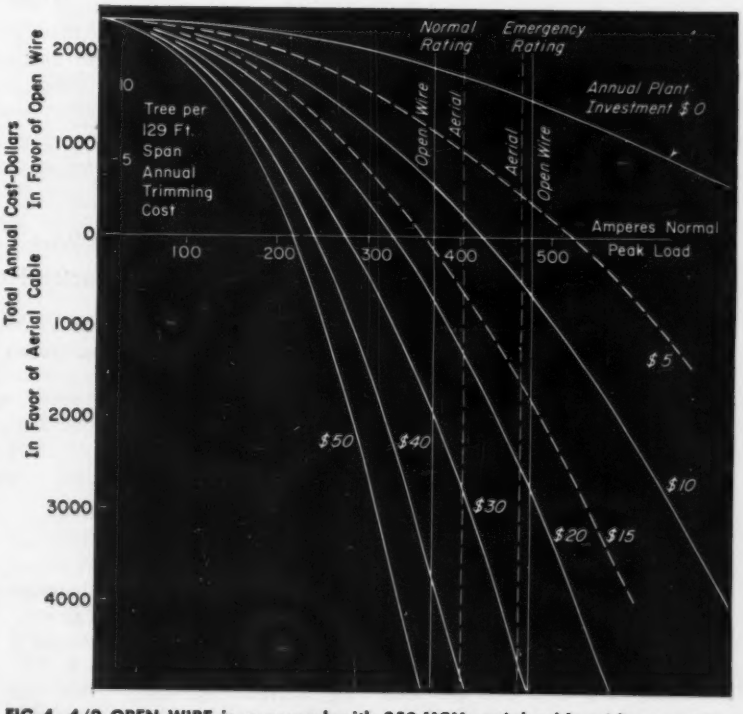


FIG 4—4/0 OPEN WIRE is compared with 350-MCM aerial cable with respect to the circuit costs, plant investment costs, and considerations for voltage drop

Table I—Costs of Hypothetical Mile of Line

(Based on 30 years life)

Conductor Size and Type	Total Installed Cost Per Mile	*Net Cost Per Mile	Annual Charges Per Mile
3 No. 2 TBWP, 1 No. 4 Neutral	$7,153.99	$8,099.45	$1,128.19
3 No. 1/0 TBWP, 1 No. 2 Neutral	$8,694.44	$9,238.48	$1,350.98
3 No. 4/0 TBWP, 1 No. 1/0 Neutral	$11,443.62	$10,945.82	$1,735.73
1/0-3/C Aerial Cable	$15,221.68	$16,241.27	$2,215.22
4/0-3/C Aerial Cable	$21,101.89	$21,017.94	$3,021.11
350 MCM 3/C Aerial Cable	$28,908.33	$27,560.65	$4,097.68

*Net cost per mile is the total installed cost less the salvage value of the conductor and materials plus the removal labor cost.

TABLE II—Investment Costs

Item	Cost per Kw	Investment Cost per Kva 90% PF	Annual Cost per Kva* % Depreciation	% Total	Total
Power Plant	$200.00	$180.00	3.1	15.1	$27.20
Subtransmission	$37.50	$34.60	3.4	15.4	$5.33
Substation	$19.45	$17.49	3.2	15.2	$2.66
Underground Cable	$9.60	$8.65	4.0	16.0	$1.38
Total	**$266.55**	**$240.74**			**$36.57**

*Additional annual cost: 4% for taxes, 2% for maintenance, and 6% for interest are included in the total%

Table III—Ampere-Miles Limits of Voltage Drop at 90% Power Factor

Voltage Drop Limit	Conductor Size	Ampere Mile: Open Wire No. 2	Open Wire No. 1/0	Open Wire No. 4/0	Aerial Cable No. 1/0	Aerial Cable No. 4/0	Aerial Cable 350 MCM
3%		62	86	127	108	198	288
5%		103	143	212	181	331	479

Table IV—Permissible Ampere-Miles for Open Wire Circuit With 3.18 Kvar of Capacitors per Mile to Correct Power Factor From 90% to 100%

Open Wire Voltage Drop Limit	Conductor Size	Ampere Mile and Required Capacitors (Three-phase) Kva: No. 2	No. 1/0	No. 4/0
3%		76 (242)	119 (380)	237 (755)
5%		126 (401)	198 (630)	395 (1,260)

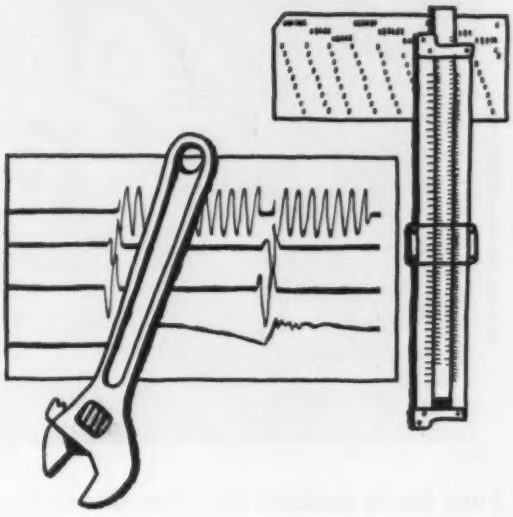
power factor slightly as the reactive drop because of load current is less than that on the open wire. Aerial cable also has a charging current equivalent to 2 to 3 kvar for each mile of line.

Aerial cable's reliability is well known. Instances have been reported of aerial cable being restored to position without service interruption after it had been taken down by falling trees during storms. Although aerial cable may require occasional tree trimming, such tree trimming is less frequent than on open wire. Furthermore aerial cable has a much less congested appearance on poles.

Disadvantages of aerial cable are just these two: Its initial cost is higher, and repairs on it cost more and take longer.

A Special Report:

Organizing Planning and Applying . . .



Modern Maintenance Methods

LEONARD M. OLMSTED, Associate Editor

Maintenance is changing. In progressive utilities today it's an engineering responsibility. This responsibility stems from the growing complexity of modern apparatus and systems and from increased dependence on reliability. It takes engineers to evaluate equipment performance, calculate the risk in extending the period between overhauls, and balance the cost of replacement power during an outage against the cost of labor and material. No longer can they afford to schedule inspection and maintenance according to tradition. Now they must detect early symptoms of impending trouble with the most accurate clinical precision and promptly prescribe correctives.

This change in maintenance philosophy is evident today throughout electric system operation. In power stations, substations, transmission and cable plant it has stimulated new techniques. Distribution also shows signs of change, but more in the development of new tools and methods than in overall practices.

Modern maintenance demands extensive and precise testing. It also demands equally extensive and precise operating records to police the condition of lines and equipment. Thus operation and maintenance merge in modern maintenance methods to the advancement of which Electrical World dedicates this special report.

ORGANIZING

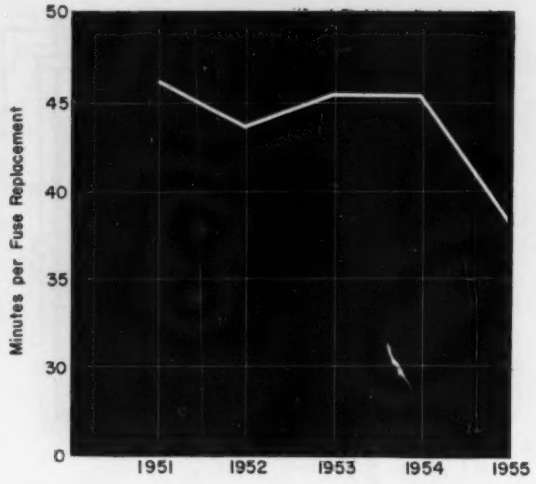
Organization Planning Promotes Efficient, Economical Maintenance . . . **page 76.** Modern Methods Cut Power Plant Maintenance . . . **page 78.** Overhauls Based on Operation Record Save Breaker Repair $$ . . . **page 80**

PLANNING

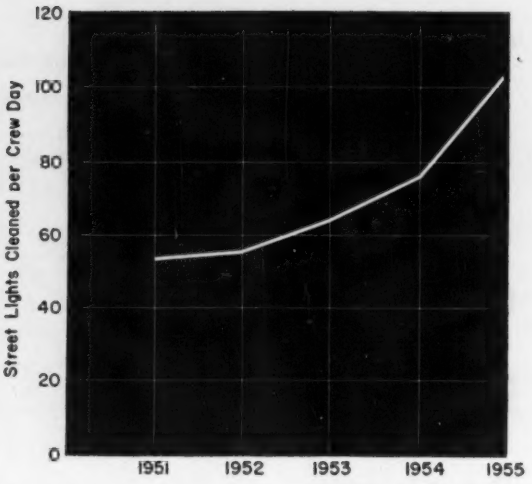
AG&E Tells How It Works 330-Kv Hot . . . **page 85.** Cable Oil Takes Special Equipment . . . **page 86,** Power Tools Speed Tree Trimming; Chemicals Improve Rights-of-Way . . . **page 88**

APPLYING

Field Vacuum Drying of Large Power Transformers Saves Time and Money . . . **page 82.** Inspect Pipe Welds by Ultrasonic Method . . . **page 84.** Hydraulic Boom Aids Mid-Span Work . . . **page 90**

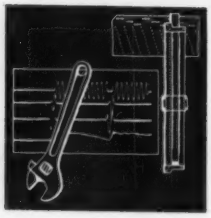


Fuse Replacements Are Speeded . . .



More Street Lights Get Cleaned . . .

Organization Planning Promotes



HARRY T. SEALY, Vice President—Distribution, Cleveland Electric Illuminating Co, Cleveland, Ohio

Planning and organizing for effective maintenance is vital to controlling the quality and cost of electric service. At Cleveland Electric Illuminating Co this important function is carried out under the tested skills and principles of modern management used in planning, guiding, and controlling all phases of the business. This article is principally concerned with distribution maintenance, which constitutes about 20% of total operating cost, exclusive of fuel, and offers a rich area for savings.

The graphs give a brief resume of accomplishments to date. They are only the highlights of generally improved operations all along the line. Taken together, they tell a story of high-order effectiveness resulting in better service for more customers at less cost.

Service crews have cut fuse replacement time from slightly over 46 min in 1951 to less than 38 min in Jan. 1955. Similar reductions have been made in the number and duration of outages from other causes.

Mechanization, coupled with better work scheduling, procedures and planning, has brought continuing improvement to street light maintenance. Street light crews have more than doubled their productivity.

Steady decline has been maintained in the most significant index of effectiveness—operation and maintenance manhours computed on a customer basis. The five-year improvement is about 20%. The Distribution Group goal for 1956 is 3.0 manhours or less per customer.

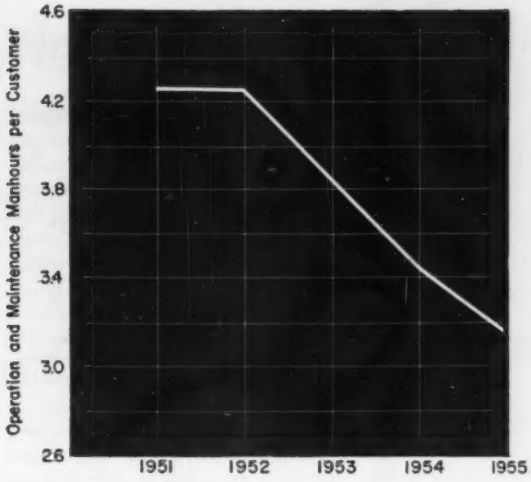
The obvious and ultimate result of better system maintenance is better service. Here the electric user exercises his prerogative as the final judge. A running tabulation of customer calls over the past 5 years reveals a 42% reduction in system and equipment inquiries and complaints per 1,000 customers and a 48% reduction in service inquiries and complaints.

Formally established mechanization and work simplification programs have been applied since 1951. Estimated cumulative savings from them at year-end 1955 amounted to $3.5 million. But these programs take a role secondary to the aggressive organization planning which brings them about and permits them to be used most effectively. Most of our management methods are proven in American industry. Our contribution has been adapting them to utility business.

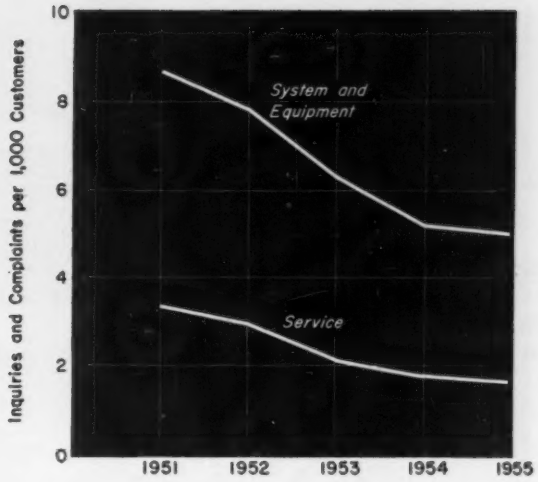
Delegation of authority and responsibility demands a clean-cut, uniform organization structure. Such a framework gives supervisors free rein for individual action yet pinpoints accountability throughout the line of command. This is the value of the Distribution Group's latest organization structure.

In setting up this organization structure, the group had as its prime objective efficient and economical maintenance of distribution in a $415-million electric system stretching over 1,700 sq mi. With the objective established, the organization structure was reviewed in the full light of sound and accepted organization principles including proper grouping of like activities, four to seven subordinates per supervisor, not more than six layers of supervision from the first level to the president, delegation of decision-making downward to bring it nearer to the point of action, elimination of one-over-one and "assistants to" positions, balance among elements, clear separation of line and staff functions, written responsibility guides for all positions. Each supervisor or specialist is appraised annually by his immediate supervisor and the person of next higher-level authority to help him develop in the job he occupies.

Under the former organization



Operation, Maintenance Hours Drop . . .



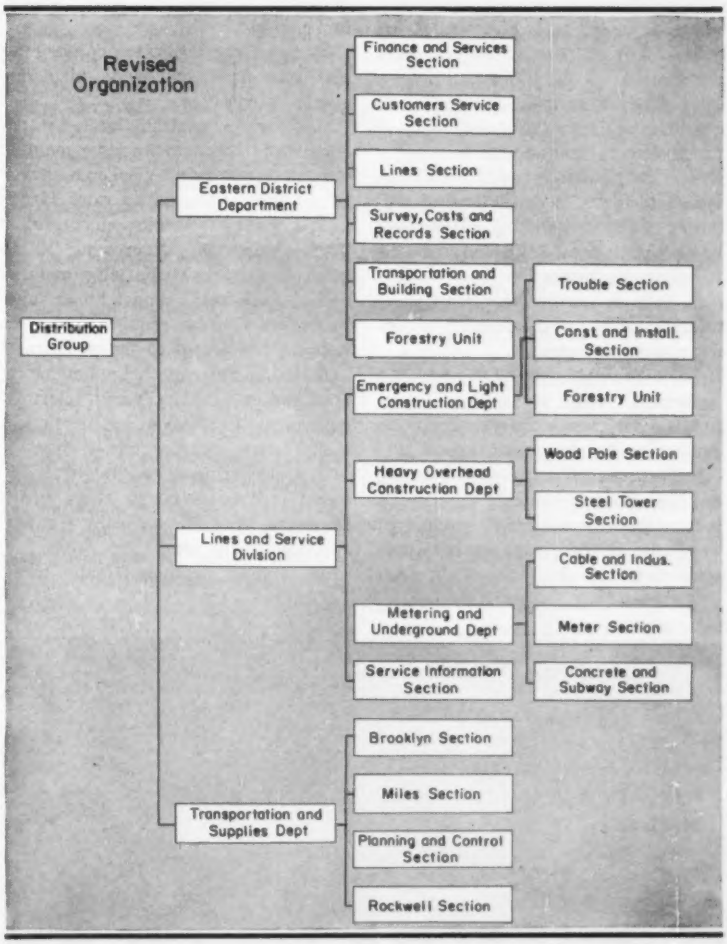
Customer Complaints Decline when . . .

Efficient, Economical Maintenance

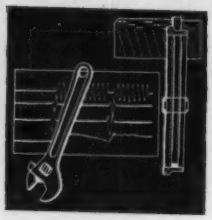
structure all customers service activities, for example, were grouped in a Customers Service Department composed of a Special Studies Unit and three sections—Office and Meter Reading, Service Operations, and Test and Investigation Operations. These activities were merged with the former Lines Division, retitled Lines and Service Division, to give it three principal departments and a section rather than the Overhead Lines and Underground Lines Departments it had.

Results have been improved working relationships, greater manpower flexibility, better crew composition, enlargement of certain jobs, generally increased responsibility and authority, prompter and more accurate decision-making at the supervisory level, and vastly improved communication and coordination.

Immediately following the reorganization, a Job Expediting Unit, one of the first in our industry, was developed and established within the Service Information Section of the Lines and Service Division. This Unit is responsible for forecasting, scheduling, dispatching, classifying, expediting, and reporting all job orders. Need for such a unit was clearly revealed in the two-year process of organization planning. It is further concrete evidence that consistent and intensive planning can bring rich bonuses in literally any area of operations.



Modern Maintenance Cuts Power



- Machine accounting plays a key part in "putting finger" on maintenance problems in the generating stations
- Maintenance engineers analyze results of machine accounting and develop improved methods for savings on future projects
- Tests guide maintenance jobs with fewer teardowns

G. V. WILLIAMSON, Vice President, Union Electric Co of Missouri, St. Louis, Mo.

Power plant maintenance has become a major problem. It costs the industry about $240 million each year, roughly equal to a fourth of the fuel bill. But these five primary approaches hold this cost in line on the Union Electric Co system:

1. Design each plant to facilitate maintenance activities.

2. Use machine accounting to point up quickly where maintenance money goes. Detailed records covering ten years provide useful performance standards.

3. Analyze records continually to improve maintenance practices and establish cost cutting methods.

4. Test frequently using highly accurate methods to detect loss of efficiency or capacity and other symptoms of incipient breakdown. Avoid dismantling for inspection.

5. Provide supervisory training and information to assist and guide maintenance supervisors.

Some concepts stressed in plant and equipment design are:

1. Leaving aisles for access to equipment for maintenance and dismantling or assembling. Time saving resulting from accessibility is essential, particularly for equipment subject to wear replacements such as coal pulverizers and pumps. Safety in this, as in most aspects of design, is also a prime objective.

2. Providing lift beams, moving rails, and hoist hooks above auxiliaries where they will be helpful.

3. Keeping plant space clear to the roof over basement hatchways for hoisting heavy units. A good-sized freight elevator to the roof is an asset for plants with roof-top fans.

4. Placing parts subject to repeated testing and inspection near the floor, or providing a platform. Ladder top inspection and maintenance are a bane and expense.

5. Paving roadways to outdoor fans and other equipment where plant design is ranch-type.

6. Providing centrally located storerooms and shops to improve maintenance performance. A boiler walkway is not good maintenance work space.

7. Locating the tool room carefully. This is important. A growing list of large and expensive portable maintenance equipment, slings, hoists, and many other items requires adequate housing convenient to the work.

8. Evaluating expected maintenance cost and availability when selecting equipment. Evaluations are mentioned in equipment specifications.

9. Considering metallurgy and design for parts subject to heavy wear. Improved availability usually justifies expenditure for long life.

10. Telling the manufacturer what lubricant is to be used. Manufacturer's operating instructions and drawings must reach the operators.

11. Giving maintenance manpower requirements per kw the same consideration as operating personnel requirements in designing a plant.

Keep Detailed Accounts

An accounting system has been developed to charge all maintenance costs so that distribution can be made against the equipment to which it is chargeable. Each major plant has some 200 separate maintenance accounts which are tabulated monthly, together with coal tonnage, pounds of steam, and kwhr generation. Maintenance cost for each unit of equipment is divided into material, plant labor, and other expense such as contract repairs and charges from without the plant. Labor costs can be converted to manhours "productive" and "allowed." The latter includes such things as sick leave.

Such records have permitted exhaustive analyses of cost trends, results of efforts to improve maintenance methods, comparison between makes of equipment and between plants.

Over and above machine accounting for cost records, a separate small engineering group studies maintenance problems from the viewpoints of plant organization and technical guidance. This group works primarily from manhour records derived from daily time slips submitted by each maintenance man or foreman. Wages to maintenance crews represent about 70% of total maintenance charges. They are the true key to a maintenance program.

The maintenance engineering group divides its approach into six categories of plant maintenance: 1. Coal handling, 2. Feedwater treatment. 3. Boil-

POWER BUGGY rushes material and tools to job site, saving manhours

ers and associated equipment, 4. Ash handling, 5. Building and employee services, 6. All other equipment serving the whole plant. There are provisions for collecting manhour data on specific equipment under study.

Analysis of daily time slips permits assigning to each function its portion of maintenance crew manhours. The yearly total of manhours under each maintenance group, divided by 2,088, gives an equivalent number of full-time men required to maintain equipment for each function. This provides a basis for studying manpower requirements for a plant; points out errors in design and operating methods; and promotes easier, better ways of doing the work.

One device for studying information in these reports is a monthly discussion between the maintenance cost engineer and representatives of each plant's maintenance organization. In addition to these discussions, a prepared round-table meeting is held between representatives of management, the maintenance organization of each plant, and the maintenance cost engineer. These meetings are held about every two months to stimulate free interchange of ideas on maintenance problems between the various plants. This program has produced important improvements.

The plant operating engineering group also determines when equipment needs inspection, test, or maintenance work. For example, boiler feed pumps are not maintained or opened for inspection until tests indicate that wear has reduced their rating below a normal minimum. Turbines are not taken down for blade fly ashing until tests show that unbalanced thrust is becoming critical or there is an economic loss in turbine efficiency or capability. Protection of men and equipment is always the basic and first consideration.

Test maintenance, sometimes called "stethoscope" maintenance, calls for tests of high accuracy to indicate internal conditions. On a turbogenerator such a test requires equipping the machine at the time of purchase and installation for highly accurate readings on stage pressures, temperatures, bearing vibration, bearing elevation to 0.001 in., spindle position, capability, and efficiency. Tests of better than 1% accuracy are required. But on modern high-speed, high-pressure, close-clearance equipment they reflect internal conditions almost as well as lifting casing.

ENGINEER AND ACCOUNTANT use accounting machine for maintenance leads

On all units installed since 1942 we have adopted this approach and dropped the "every three year" or "every four year" approach. It is felt that more harm than good can be done by unneeded opening of high pressure casings where bolts, piping, and joints are damaged on each occasion. Elimination of one 3-week outage on a large unit can save $200,000 in system operating costs and is eminently worth the test effort.

Management Sets Pattern

Management accepts responsibility for training plant supervisors about the ways and tools of management. Trained personnel is loaned to each powerhouse to help develop methods of analysis.

Management provides adequate criteria of maintenance performance and costs. Such records are revealing, adequately detailed, and promptly available. They are set up to give to plant management those costs over which it has control, separating out other charges such as those by centralized staffs. Charges are keyed to manhours.

Operating management of a plant covers these seven functions:

1. Developing a full training program for supervisors covering their responsibilities and relations with crews in caring for equipment under their control.

2. Training and selecting good maintenance mechanics and then giving them all the support, tools, and recognition they deserve.

3. Making required materials readily available. Union Electric avoids lineups at the storeroom and assures prompt and rapid supply of material by using powered delivery trucks. A list prepared in advance for each job is used to fill padlocked palettes of maintenance material which are delivered on lift trucks. In this way, most material, down to small bolts, is at hand when the job starts.

4. Planning maintenance assignments a day in advance. This permits foremen to start jobs promptly.

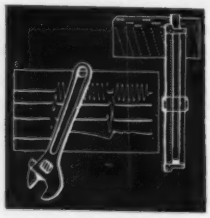
5. Assigning certain maintenance crews to trouble shooting. This minimizes "borrowing" from other organized crews for hurry up jobs.

6. Following up on maintenance requests using an index to keep the many little jobs from being postponed indefinitely. A successful method, followed by one plant, has been to hang these written requests in transparent envelopes on the equipment itself. Requests are dated, and the master mechanic keeps posted on the backlog of maintenance items.

7. Providing engineer-economic guidance to resolve the conflict between drive for low maintenance costs and best equipment efficiency or system wide performance. Low maintenance costs at the expense of excessive fuel waste, reduction in plant capability, or equipment wrecks, are false economy. The right economic balance is hard to determine.

Overhauls Based on Operations Record . . . .

Save Breaker Repair $$



- Scheduling inspection only when operation-severity count reaches pre-assigned limits frees crews for other duties
- Period limited to 3 years

WM. T. HANNUM, Electrical Superintendent,
JOE SMITH, Supt. Substations and Communication, North Bay Division, Pacific Gas & Electric Co, San Rafael, Calif.

Number and severity of fault operations are keys to a system-wide program for circuit breaker maintenance followed by Pacific Gas & Electric Co. This program is aimed at the dual objectives of adequate, modern maintenance: Overhaul of equipment when necessary to reduce probability of failure and attendant outages, minimum maintenance expense through elimination of unnecessary overhauls. The program has been modified recently to apply knowledge gained from several years of use.

Experience with the maintenance program in the company's North Bay Division, one of the first to put the modified plan into effect, has been most encouraging. There has been no rise in breaker outage time or frequency while maintenance costs have been cut. These reduced expenses can be traced to overhauls only when necessary and not on the rigid annual basis formerly required. And fewer overhauls have relieved crews for other maintenance.

Work done by the maintenance crews is a measure of this additional available time. The North Bay Division, located along the Pacific coast above San Francisco Bay, stretches

PACIFIC GAS AND ELECTRIC COMPANY
RECORD OF CIRCUIT BREAKER
FAULT OPERATIONS
(INSTRUCTIONS ON REVERSE SIDE)

SHEET No. 1

STATION A PERIOD 4/28/55 TO

BREAKER NO.	TYPE	LINE KV	UNITS ASSIGNED PER OPERATION MIN. - MAX.	AGGREGATE UNIT OPERATIONS AND DATES																						REVIEWED BY	DATE
				DATE	UNITS	DATE	UNITS	DATE	UNITS	DATE	UNITS	DATE	UNITS	DATE	UNITS	DATE	UNITS	DATE	UNITS	DATE	UNITS	DATE	UNITS	DATE	UNITS		
152	FHKO-69-60-8	110	10-20	4/1	28	8/18	20	7/11	50	Total	98	Overhaul															
52	JE-42E	60	10-20	4/1	58	7/9	40			Total	98	Overhaul															
110%	FKO 37	12	50-100	4/28	100					Total	100	Overhaul															
81	RGE-OD	60	100-100	4/1	0	11/11	200			Total	200	Overhaul															
1103	JCE-2H	12	10-20	4/1	35	11/11	25	4/11	15																		
40%	50-DB-50	5	10-20	4/1	0	7/10	25	3/15	20	11/11	10																
162	RHE-64-H	115	20-20	4/1	20	11/11	90																				

STANDARD FORM is filled in as breakers operate. Units are entered on a daily basis

about 160 mi between the farthest substations north-to-south and about 75 mi east-to-west. It has eight two-man maintenance crews and four maintenance supervisors. The crews do all maintenance at 66 substations with some 265 circuit breakers. In addition they maintain all service restorers and pole-top regulator installations. The time required is more apparent when it is considered that crews must travel up to 75 mi in good weather and 100 mi in bad weather to reach some substations.

Under the original program, all breakers rated 6.6 kv and above were overhauled after 125 unit operations or annually, whichever came sooner. Breakers under 6.6 kv were overhauled on a 125-unit-operation or three-year basis. One of the disadvantages of this was that the number of unit operations charged for a specific fault operation was left to the discretion of individual station operators. Faults were rated by the operator based on sound, amount of oil spilled, breaker type and age, and previous experience with similar equipment. It was difficult, therefore, to compare the ratings different operators were charging to fault operations, even on the same breaker.

The present maintenance program is based on a more uniform and systematic rating plan that can be used by all maintenance personnel. Key to this is a simple means for relating capacity of the breaker to severity of the fault. Each fault operation is charged a number of units as was done previously. These units are charged so that a breaker may be scheduled for overhaul when the aggregate of units reaches 100. Thus, if it is determined that a breaker can operate ten times under a given fault condition before overhaul is necessary, then ten points are charged for each such operation.

For uniformity in charging units per operation, minimum and maximum unit values are assigned to each breaker. Minimum units are for faults at or near the end of a line. Maximum units are used for close-in faults, bus faults, or for faults involving maximum breaker stress. Intermediate faults are assigned values as determined by distance between breaker and fault location.

Determination of maximum-minimum units is based on available fault current as calculated from characteristics of the line and the capability of the breaker. Maximum duty at the station is calculated with all breakers in the station in normal operating positions. Breaker capability is based on nameplate interrupting capacity for equipment manufactured within the last 15 years. For older breakers, maximum capability is based on type, age and field experience. The accompanying table shows the assignment of maximum-minimum units based on these factors.

A standard form is used to record and evaluate fault conditions of station breakers rated 2.4 to 230 kv. This form is maintained by the station operator or foreman in charge. At unattended stations the record is kept by the maintenance crews. Records are reviewed at least every six months by the maintenance supervisor. A standard form with typical record experience is illustrated.

This new rating system will extend the time between overhauls for some breakers. However PG&E feels that periodic overhaul of all breakers is necessary. Accordingly the maximum period between overhauls for any breaker, regardless of the aggregate of unit values, has been set at three years. New breakers are overhauled initially no later than one year after being placed in service.

Overhaul for all breakers includes a thorough inspection of the operating and control mechanism; dressing or renewing of contacts; reconditioning of oil for oil circuit breakers; and other repairs, replacements, and adjustments as needed. At least every six months all breakers are given an outside inspection, and mechanisms are tested for proper operation.

Maintenance routine is modified for breakers which are operated frequently but ordinarily not under fault conditions. This covers such equipment as railway and machine breakers and street light primary breakers. These units are overhauled at least annually. If such breakers operate under fault conditions, however, they are assigned operation units like other breakers, and overhaul is governed accordingly.

Units of Operation Severity Depend on Duty and Rating

	Oil Circuit Breaker				Mva duty available,		Breaker	Severity Units	
Substation	No.	Make	Type	Kv	at breaker	at end of line	rating, Mva	Max	Min
Alto	12	PG&E	37473-EX	60	242.0	90.0	250.	100	50
	22	PG&E	37473-EX	60	242.0	125.0	250.	100	50
	401	PEM	JC-17	15	57.5	10.0	50.	100	50
	403	PEM	JC-17	15	57.5	9.2	50.	100	50
	404	PEM	JC-17	15	57.5	8.6	50.	100	50
Bolinas	1101	PEM	JC-17	15	15.3	10.5	50.	25	10
	BK1/2	PEM	JC-17	15	15.3	12.5	50.	25	10
Ignacio	152	GE	FHKO-39-60-B	115	600.0	200.0	1,500.	20	10
	162	GE	FHKO-39-60-B	115	600.0	200.0	1,500.	20	10
	12	PEM	JE-42-E	69	440.0	275.0	1,000.	20	10
	22	PEM	JE-42-E	69	440.0	143.0	1,000.	20	10
Marin		GE	FH-6	15	32.7	32.7	100.	50	50
		GE	FH-6	15	32.7	9.4	100.	50	50
San Rafael	405	GE	FK132A	15	42.5	28.0	40.	50	25
	406	GE	FK132A	15	32.8	14.8	40.	50	25
	1103	PEM	JCE-22-C	14.4	128.0	38.4	250.	20	10
	1104	PEM	JCE-22-C	14.4	128.0	46.5	250.	20	10
Larkspur*	1194	WEST	50-DH-50	5	14.5	6.5	50.	20	10
Fairfax*	1192	WEST	50-DH-50	5	17.1	9.0	50.	20	10
Kentfield*	1110	GE	AM 5-50-4	4.1	20.0	3.3	50.	20	10
San Anselmo*	1106	GE	AM 5-50	4.1	21.0	9.7	50.	20	10

*Unit substations

Fig 1 – Gas Expands as Vacuum is Pumped

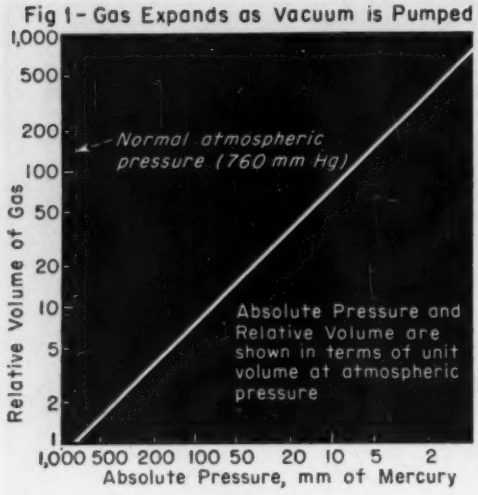
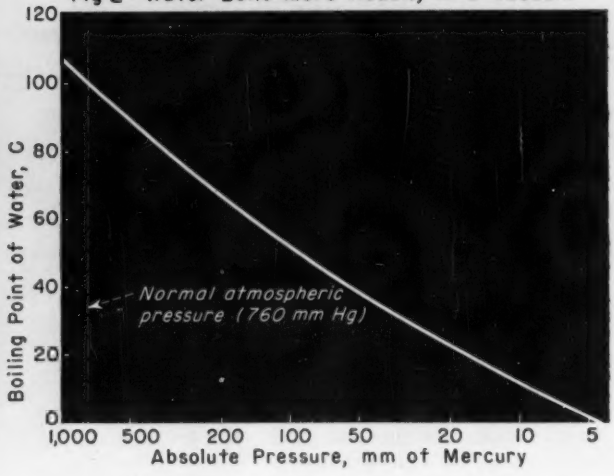
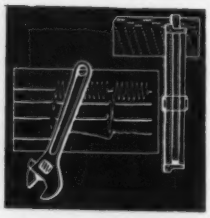


Fig 2 – Water Boils More Readily in a Vacuum



Field Vacuum Drying of Large Power



- New method achieves improvement in insulation power factor and resistance with equipment available for field work
- Accurately controlled hot air drives off moisture which is removed with vacuum pump. Knowledge of atmospheric temperature and humidity guards against readmission when oil is returned to transformer tank

PAUL EVANS, JR, Design Engineer, Transformer Division, Westinghouse Electric Corp, Sharon, Pa.

Vacuum drying large power transformers in their own tanks provides a solution to the growing problem of adequate drying in the field and in repair shops with minimum expenditure of time and money. The new method is faster than conventional oven drying followed by vacuum oil impregnation. It achieves a considerable reduction in insulation power factor and an increase in insulation resistance, using relatively inexpensive and portable components that are generally available.

Transformers are heated in this drying method by circulating hot air through windings and insulation from an external air heater. Tanks are then sealed and a vacuum drawn of not over 10 mm of mercury absolute pressure. After drying is completed, the transformer is filled with oil before vacuum is relieved. Typical heating time is 40 to 50 hours followed by vacuum applied for a minimum of 42 hours.

A forced-air system is used for heating air with steam-to-air heat exchangers. Temperature of air leaving the heat exchanger is controlled by a simple on-off thermostat and a solenoid valve in the steam supply. Massive volumes of air are introduced through all openings in the bottom of the transformer tank and allowed to vent through the manhole. Air requirements are estimated as 15 cfm for each sq ft of tank surface, excluding cooling equipment such as radiators.

Can Use Electric Heat

Heating power is estimated as 60w or 3.4 Btu per min for each sq ft of tank surface. These values are minimum and can be exceeded as the volume is self-limiting and the air temperature controlled. The heat source must provide sufficient transfer surface.

Electric heating elements may be used as long as their maximum temperature stays under 150C to avoid accidental ignition of oil vapors. Such elements are controlled by a contactor operated from the thermostat instead of a solenoid valve.

Air is heated at the blower intake to provide more uniform temperature at the point of delivery to the transformer. Heated air is distributed by a plenum chamber easily made with domestic hot-air distributing pipe. The thermostat bulb is placed in this plenum chamber.

The drying procedure is based on theoretical knowledge and experience gained from field and factory drying. Steps are:

1. Heat transformer until insulation resistance values are constant for 4 consecutive measurements two hours apart. Hold hot air entering the transformer to 115C average, 120C maximum, for dry insulation. This temperature is reduced to 100C average, 110C maximum, for oil-soaked in-

Fig 3 – High Humidity Boosts Condensation Risk

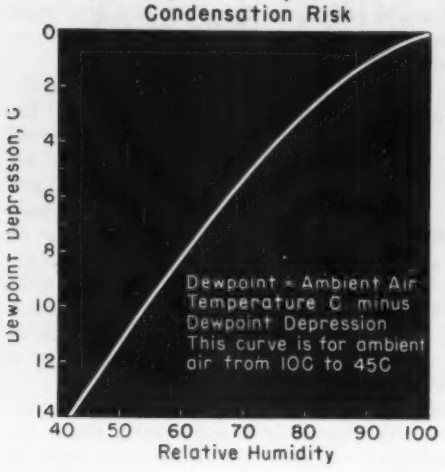
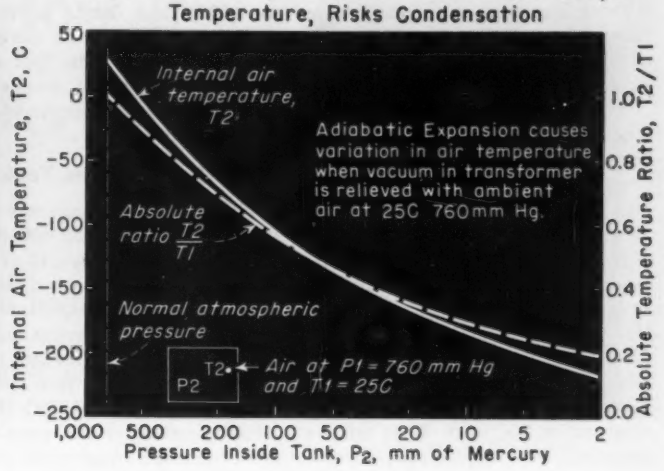


Fig 4 – Admitting Air to Evacuated Tank Drops Temperature, Risks Condensation



Transformers Saves Time and Money

sulation to prevent spontaneous combustion for which the threshold temperature is 120C. It is necessary, of course, to have good temperature control in order to work safely as high as 110C maximum.

2. Seal transformer tank and apply vacuum. Stored heat in the transformer structure vaporizes any remaining water. Absolute pressure in the tank is reduced rapidly to below 10 mm of mercury. Pumping is continued until four consecutive measurements of insulation resistance at two-hour intervals are essentially the same. The transformer is then considered dry enough without unnecessary dehydration and consequent deterioration of its insulation.

3. Connect oil supply to the transformer and start filling while maintaining vacuum at 10 mm or less. Oil is sprayed in from the top of the tank to deaerate and dry the oil. The level should be raised a few inches above normal before vacuum is relieved to compensate for the drop in level as the tank resumes normal volume.

Removes Water and Gas

Primary purpose of vacuum drying is two-fold: To remove moisture and to remove as much occluded gas as possible at reasonable cost. The transformer is heated to store heat in the insulation, coils, and punchings. This stored heat vaporizes water removed during vacuum drying and increases water vapor pressure to accelerate the vacuum drying process.

Removal of gas occluded in crevices among insulation fibers is essential for thorough impregnation in the short time available for oil penetration before dielectric tests are made. In normal vacuum drying and filling, the maximum absolute pressure is 10 mm of mercury. This corresponds to an expansion of 75 times original volume at atmospheric pressure, Fig 1. Normal finishing pressure is 5-6 mm with corresponding expansions of 125-150 times.

Reduction in pressure produces a corresponding reduction in the boiling point of water, thus expediting the drying. Fig 2 shows its boiling point at 10 mm absolute pressure to be only 12C while at 5 mm it is only 1¾C. Maintaining vacuum for sufficient time at about 20C will remove the desired amount of water.

Considerable cooling, which takes place as drying proceeds, can present a real problem if the transformer is not preheated. Water extracted by the vacuum may reach 20 gal, which removes approximately 190,000 Btu by vaporization. Heat is lost, also, by radiation and convection from the tank and heat in the air removed.

Difficulty may arise from condensation of water under normal ambient atmospheric conditions if the vacuum is relieved. Such condensation can occur when moist warm air contacts a cool dry surface. Whenever moisture laden air is cooled below the dew point, water condenses on all adjacent or surrounding surfaces. Condensation takes place regardless of whether the surface is cooler, the same temperature, or warmer than the air, unless the surface is warm enough to heat the adjacent air layer above the dew point. Fig 3 shows the dew point for various relative air humidities and temperatures.

Must Watch Weather

This condition may give trouble in the spring or fall when nights are cool and days are warm and humid. A transformer, standing without excitation for several days, follows ambient air temperature and may cool during the night to 10C. At 9 AM air temperature is 25C with 65% relative humidity, but the transformer has warmed up to 15C. Conditions then are: ambient air 25C, humidity 65%, dew point about 18C. If this unit is opened, warm moist air entering the gas space will be cooled to 15C, or 3C below its dew point, and moisture will condense on internal parts. If the humidity had been lower or the transformer only 4C warmer, no condensation would have occurred.

The only safe rule to follow in opening a sealed transformer is to avoid periods when its temperature is lower than the surrounding air. Preferably its temperature should be

higher than the air. But when humidity and temperature conditions are known, it is sometimes safe to open transformers a few degrees below ambient air temperature.

Another condensation condition arises when air is cooled rapidly to below the dew point. Moisture then causes fog or dew on surfaces that may be warmer than surrounding air. Men installing or drying transformers with high vacuum may be puzzled by experiences like this:

A transformer has been heated to 90C by circulating hot air through its windings. Air has been shut off and vacuum applied for 50 hours. The tank has cooled to 28C and ambient air is 26C with 80% relative humidity. The transformer, according to power factor and resistance measurements, is quite dry. It is filled with oil at 25C to the normal level. Vacuum of 25 mm is relieved and the manhole opened. Then drops of water are observed on the inside of tank cover and walls.

This condensation is not hard to explain. The dew point is 23C. Oil has lowered tank wall temperature to 25C leaving only a 2C margin to prevent water preciptation. In relieving the vacuum, the air expands essentially adiabatically into the gas space. Initial expansion cools the entering air to—160C; and then, as pressures equalize, its temperature increases to perhaps 10C below the 26C ambient air. This is 7C below the dew point; so moisture is condensed onto all surrounding surfaces.

Admitting Air Cools Tank

Fig 4 shows the temperature variation of air expanding adiabatically into an evacuated vessel. If air at 25C was expanded into a vessel where no heat is added and the expansion started at 10 mm absolute pressure and ended when vessel pressure reached the ambient, the initial air just inside the orifice would be at —185 C. Average air temperature in the vessel at the end of pressure equalization would be at about —30C. In actual transformers, however, the tank wall and oil warm the air and 5 to 10C depression is the most that may be expected.

This depression of temperature means that relative humidities above 55% in the entering air may cause condensation when vacuum is relieved. Condensation may be only momentary as re-absorption by the air can be fairly rapid with humidities up to 75%. The water may evaporate to remove all evidence before the tank can be opened. But relative humidities 80% or higher do not give rapid evaporation, and water droplets may persist for a long time.

The total moisture deposited in this example would be 0.05 lb per 100 cu ft of gas space or about one fluid ounce. Although it looks bad distributed over the tank surface, perhaps not more than 1/6 fluid ounce is introduced into the oil. Water on the tank wall is evaporated by the air, particularly if air is circulated in the gas space by a fan. This appearance of water does not necessarily indicate that the transformer is wet, but it raises a question.

It is important, then, to prevent entrance of ambient air to relieve the vacuum. The transformer may be filled completely with oil and subsequently drained enough after vacuum is relieved to obtain the proper oil level. But the most satisfactory method is to relieve vacuum by admitting dry nitrogen to equalize pressure in the gas space with that of surrounding atmosphere. Moisture from the air is thus avoided.

Vacuum, to be effective for initial impregnation of fibrous insulating material, should be high. An absolute pressure below 10 mm of mercury is essential.

Inspect Pipe Welds by Ultrasonic Method

W. A. POLLOCK, Wisconsin Electric Power Co, Milwaukee, Wis.

Testing welds in power plant piping has been greatly simplified by use of ultrasonics. The technique resulted from Wisconsin Electric Power Co's developmental program at Oak Creek Station. Backing rings were eliminated there by designing a weldend detail adapted to use of a tungsten welding electrode with an inert shielding gas.

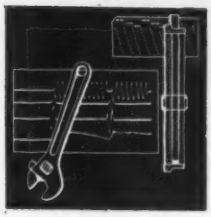
Discovery of the adaptability of relatively low-cost ultrasonic inspection was an important byproduct of developing the new welding technique. The utrasonic method has proved entirely practical, and it can replace more expensive inspection methods.

Equipment required is small and easily portable. To inspect a weld, a crystal projecting sonic impulses by the "shear-wave-technique" is held a few inches below the completed weld. The sonic impulses are projected obliquely to inspect for transverse cracks. Discontinuities are indicated on an oscillograph-like instrument.

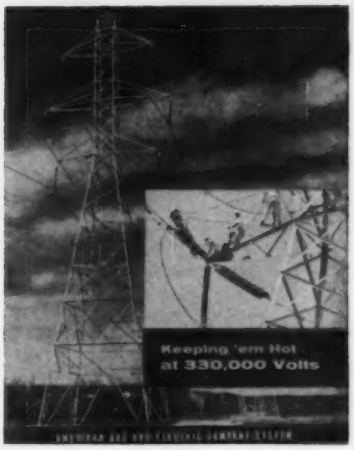
Advantages favoring ultrasonic testing include:

1. Greater speed.
2. Comparatively low cost.
3. Exceptional portability of equipment.
4. Retests may be made where minor defects are noted.
5. Reinspections examine the entire weld for soundness; they do not require drilling a hole for radio active cobalt insertion and subsequent stress relieving of the repair.
6. An independent referee is obtained when inspection is contracted to a company providing this service.
7. Retests are readily made after periods of operation to assure that cracks have not started.

AG&E Tells How It Works 330 Kv Hot



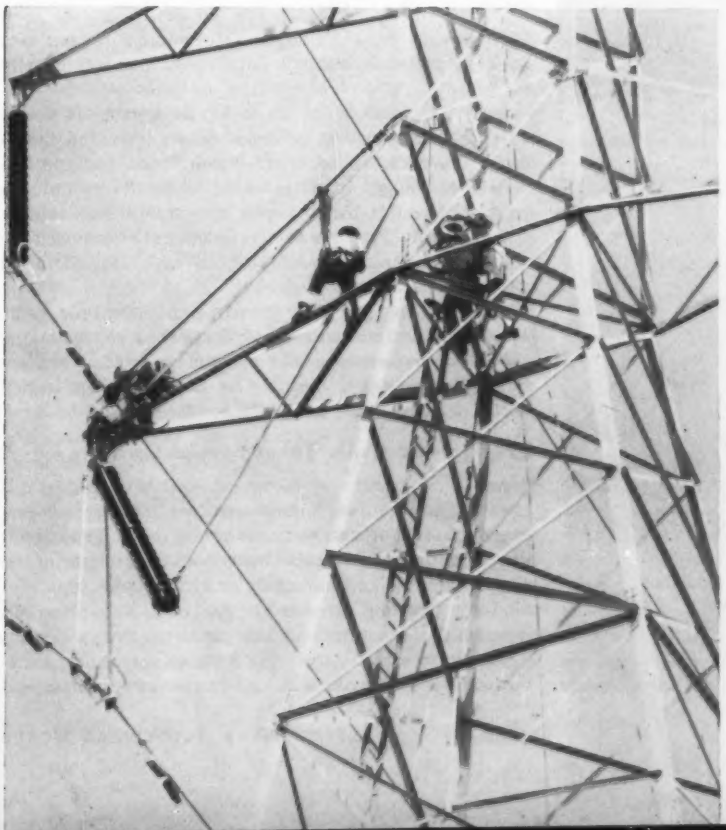
Three methods for maintenance of insulators and conductor hardware on suspension and anchor towers are revealed in new booklet depicted at right



No transmission voltage used in the United States has been found unsuited to hot-line maintenance on open-wire lines. A booklet just released by American G&E Co shows with step-by-step pictures how this technique has been adapted to 330-kv transmission. Of three methods depicted, two show maintenance of insulators and conductor hardware on suspension towers. The third applies to anchor towers where the 10,000-lb conductor tension must be held while insulators are swung with a temporary boom from their nearly-horizontal operating position to a safe-working zone.

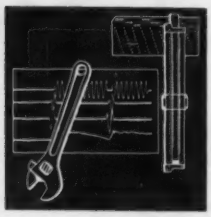
Adoption of 330 kv in 1951 as the most economical voltage for AG&E's bulk transmission network focussed attention on development of maintenance methods. It was necessary to keep lines in service while damaged insulators or hardware was changed. Doing this would spare customers from needless service interruptions and keep system capacity at its peak without costly duplicate lines.

Hot stick methods had accomplished these objectives successfully on lower voltage systems, but they had never been applied to 330-kv work. Accordingly a research and development program was inaugurated to develop safe methods and equipment for use on the new system. Results of this program are revealed in the booklet.



PHOTOGRAPH from booklet shows insulator string disengaged from conductor suspension clamp and supported by cradle to be swung up to arm for replacing a damaged unit. Conductor is supported by two lifting sticks on hoisting lines passing over temporary sheaves at arm end and terminating at tower legs. Alternative method hoists lifting sticks with jack screws at the arm end and rolls insulators with a trolley to a clear position for lowering them to workmen on the ground

Cable Oil Takes



R. A. HORENBERGER, Underground Section, Transmission & Distribution Dept, Philadelphia Electric Co, Philadelphia, Pa.

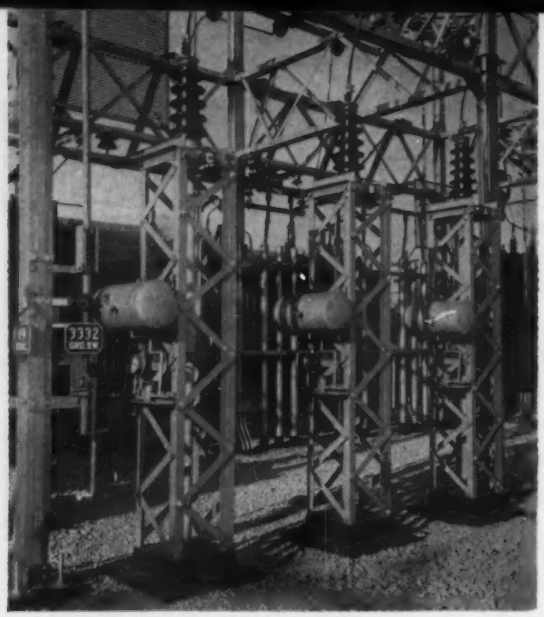


FIG 1—NITROGEN RESERVOIRS take up oil expansion at 33 and 69-kv heads. Cell-type installations look similar

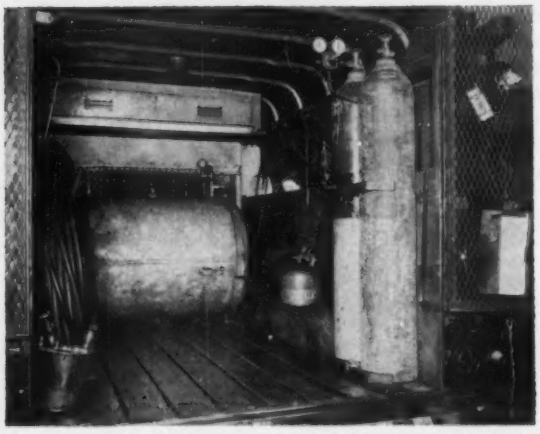


FIG 2—TRUCK-MOUNTED EQUIPMENT handles oil for 69-kv solid cable. Nitrogen bottles pressurize 150-gal oil tank

FIG 3—ELEVATED TANKS maintain oil pressure by gravity on the 69-kv low-pressure, oil-filled, hollow cable system

Oil for splices and potheads of various types of paper-insulated cable in the 33 to 69-kv range calls for widely different techniques in treatment and supply. Equipment required for installation and maintenance varies from an inexpensive hand pump to a completely self-sufficient, truck-mounted oil-treating unit.

Solid-type paper-insulated cable operating at 33 kv and 69 kv on the Philadelphia Electric System has most of its accessories insulated with low-loss varnished-cambric tape. Such accessories are normally filled with oil by merely venting to the atmosphere while oil is admitted from a reservoir or pump. Exception is a few 33-kv "Y" splices insulated with crepe paper. These must be vacuum treated when oil is added to assure re-impregnation of the tape. On some occasions, especially in cold weather, it is expedient to use vacuum to draw the filling oil into all accessories on these solid-type cables.

Nominally high-viscosity oil is used on 33-kv cables and light transformer oil in the 69-kv system. Both cell-type and nitrogen-pressure-type oil reservoirs are used for both voltages. Fig 1 shows nitrogen-pressure reservoirs on 33-kv potheads; cell-type installations look substantially the same.

Over 25 circuit miles of 69-kv solid cable is nearly 30 years old. Concrete corrosion, electrolysis, and sheath breaks have caused so many sheath leaks that approximately 45,000 gal of oil is added to the reservoirs each year. This oil is handled with two trucks each with a 150-gal tank. Pressure to fill reservoirs is provided by admitting dry nitrogen into the oil tank. Fig 2 shows one of these trucks.

These techniques have proved satisfactory for cable accessories. But standard accessories in these voltage ranges for solid-type paper-insulated cable may include manufacturers' instructions calling for vacuum treatment which should, of course, be followed.

Low-Pressure Cable Takes Special Care

Another 26 miles of 69-kv cable is low-pressure oil-filled of the Pirelli or hollow-core type. Satisfactory performance of this system demands very careful oil treatment. Evacuation of cable accessories and all connections in the oil feed system is as important as a continuous supply of oil from the time cable is shipped until it is placed in service. These requirements also pertain to any subsequent work on the cable system. Fig 3 shows a typical gravity-feed cell-type reservoir with two reservoirs per phase and

Special Equipment

- **Reservoirs at cable terminals and devices for handling oil reflect varied requirements**
- **Equipment includes "Degasser" truck, engine-driven vacuum and oil pump trailers**
- **Pipe cable has permanent pump installations to handle its oil**

each phase monitored individually by a float level relay.

A truck-mounted treating unit provides treated oil and facilities for evacuation. The truck also contains a 10-kw gasoline-engine generator to give it complete freedom of action. The unit holds 60 gal of oil which it treats by circulating through atomizing spray nozzles into a vacuum dome. The vacuum pump may also be operated independently from the oil unit for evacuation work.

Fig 4 shows the equipment in a "Degasser" truck. The spray dome is at the top of the treating unit with inspection ports on each side. The thermostatically controlled oil heater is at the left behind the body of the unit and the oil-immersed oil pump is behind the foot of the left hand column. To the right and below the body of the treating unit is a 27-cu-ft-per-min vacuum pump. In addition to vacuum treating and oil filling all splices, potheads, and oil reservoirs for the oil-filled cable, this unit has proved valuable on other jobs because of its ability to heat and pump a reasonable quantity of oil, a task which would be very difficult otherwise under winter conditions.

Pipe Cable Oil Is Volume Job

The newest 69-kv cable is high-pressure pipe-type. About 33 circuit miles are in service and more is being added. All but one mile of this is oil filled. Obvious difference between this and previous systems, other than the operating oil pressure, is the scope of various operations. Where the low-pressure oil-filled system requires treatment only of small units such as a splice, pothead, or oil reservoir, the pipe-type system calls for evacuating long lengths of pipe and handling large volumes of oil. It is necessary to think in terms of miles of pipe and thousands of gallons of oil. Obviously larger equipment is required.

Two trailer-mounted 100-cfm vacuum pumps such as shown in Fig 5 are used. These pumps are fitted with 30-gal trap tanks so that oil can be flushed out of the pipe into the tank when filling the pipe. Vacuum pumps are gasoline-engine driven to provide the greatest independence of operation.

Another trailer carries a 35-gpm gear-type oil pump used to transfer oil from tank trucks to the pipe line. It is fitted with a pressure gage and regulating bypass so that its output pressure can be controlled as desired. This unit also is engine driven.

Each pipe cable is connected to one or more automatic pumping plants so that 200-psi oil pressure is maintained. Fig 6 shows one of the earlier installations with a 3,000-gal oil reservoir.

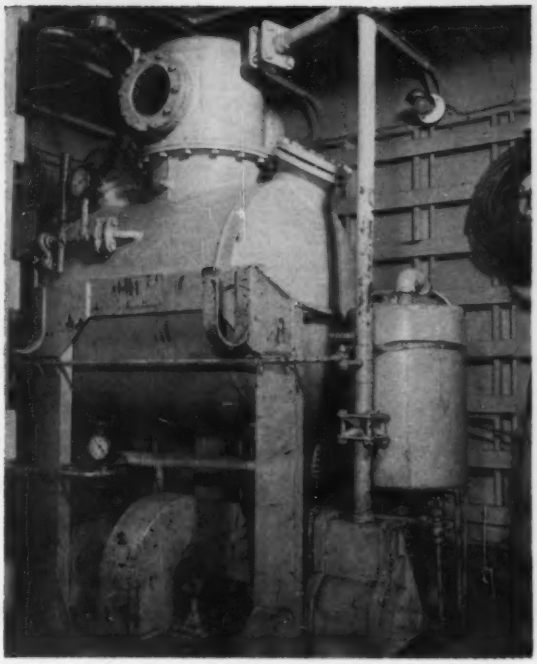
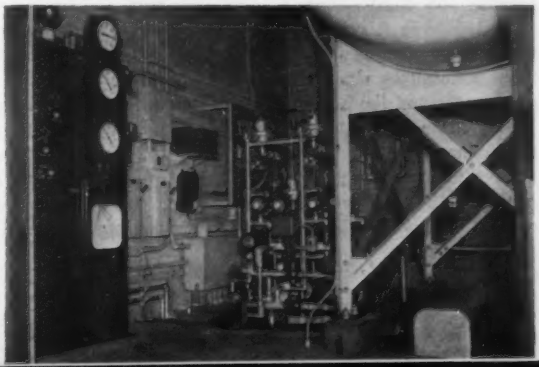
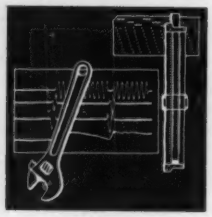


FIG 4—"DEGASSER" TRUCK houses complete treating unit. Oil from heater (hidden) is sprayed in dome of vacuum tank (center). Vacuum pump (right) can be used independently

FIG 5—TRAILER carries engine-driven vacuum pump for pipe-cable work. Another unit has 35-gpm gear-type oil pump

FIG 6—PUMPING STATION keeps pipe cable oil at 200 psi. Dual pumps with pressure relief are controlled from panel





With tanks loaded by supply truck at highway . . .

Power Tools Speed Tree Trimming;

RALPH I. KAUFFMAN and HYLAND R. JOHNS, Asplundh Tree Expert Co, Jenkintown, Pa.

Trees and vegetation take on new importance every year in provisions for operating and maintaining electric systems. Expansion to supply growing loads requires new lines in areas not previously developed and feeders along routes formerly eschewed because of undesirable tree conditions. And nature strives continuously to close the gap between trees and overhead lines. These growth factors, aggravated by mounting labor rates, have pushed line clearing and rights-of-way maintenance costs so high that most utilities demand a more economical and effective approach.

Line clearing and rights-of-way maintenance are distinctly separate functions, but they have certain objectives in common. Among these are:

1. Improving service continuity by eliminating avoidable tree interference with overhead lines.

2. Providing clear access for more economical and effective line maintenance and construction.

3. Satisfying a critical public that an effective clearing job can be done without desultory effects on cherished shade trees and landscapes.

4. Getting the best possible results per dollar spent.

Tree interference on some systems causes 40% of service interruptions; during storms this figure approaches 90%. Interruptions foment dissatisfaction among utility customers whose lives are geared to their appliances.

Accepting the fact that some line trouble is inevitable, clear access permits faster repair of damage and quicker restoration of service. A line not hidden by trees or inaccessible because of growth in the right-of-way can be inspected more thoroughly for preventive maintenance. Distribution particularly is subject to frequent alteration and reinforcement to meet load growth demands and ready access cuts construction costs.

Experts Must Do the Job

Assigning tree and rights-of-way work to qualified experts who recognize their obligation to the public has contributed toward alleviating antagonism created by past practices. Careful public relations programs are winning acceptance of the philosophy that trees are not harmed by scientific trimming. They have also won recognition that proper treatment can promote beneficial vegetation on rights-of-way.

It is in methods for achieving best results per dollar that greatest progress has been made. But these methods differ radically between rights-of-way control and line clearance, reflecting the basic difference between control at ground level and at line level.

Improvements in rights-of-way control hinge largely on chemical sprays. Techniques in common use are:

1. 2,4-D, 2,4,5-T, or Ammate in water for broadcast applications.

2. 2,4-D and 2,4,5-T in an oil-water carrier for semi-broadcast application as a cane-foliage spray.

3. 2,4-D and 2,4,5-T in oil for basal summer or winter application.

A demonstration area at Pennsylvania State University under supervision of Dr W. C. Bramble was designed primarily to evaluate the effect of these materials and techniques on game food and cover and to measure results when they are applied at peak efficiency. Other test areas also show significant indications.

These tests definitely prove good formulations hold a well-defined superiority over those formulated to meet a competitive price. Pounds of acid per acre is not the only yardstick needed to measure results, but, coupled with good application, it controls the efficiency of chemical applications. Brush density, height, species, and terrain all have a bearing on what can be used to produce brush free rights-of-way.

Broadcast sprays are not so tolerant of low vegetative ground cover as basal treatment. Game commissions, forestry and highway departments, landscape engineers, garden clubs, and the traveling public object to repeated broadcast applications which produce unsightly brown areas and reduce game food and cover.

spray truck feeds man-aimed hoses . . .

to control right-of-way vegetation

Chemicals Improve Rights of Way

Chemical brush control is an excellent and more economical right-of-way treatment when used properly with consideration of local conditions and scheduled performance. Any application which ignores these factors will produce discouraging results.

Broadcast waterborne 2,4-D and 2,4,5-T is the fastest and cheapest method. It will kill sumac, sassafras, sweet gum, wild cherry, etc. But it only defoliates hard-to-kill species such as ash, red maple, oak, and hickory. When used in quantities necessary to produce best results, it is hard on low ground cover such as blueberry and fern.

Oil-water 2,4-D and 2,4,5-T is as effective on easy-to-kill species and does a much better job on the hard-to-kill. Application is semi-selective and more thorough. It requires more material than waterborne but gets all woody vegetation to ground level, making follow-up basal applications practical and economical.

Cane-Foliage, Basal Best

Oil-water applications to canes and foliage, followed by oil-basal treatment thereafter, provide the best and most economical right-of-way maintenance. Properly scheduled and applied, they make brush elimination practical and economical. Cane-foliage sprays require better formulations to carry properly extra oil. They require intelligent and thorough application to get all brush to ground level and make oil-basal follow-ups practical and efficient. But oil-water followed by oil-basal treatments eliminate the most brush for the least cost and produce a right of way acceptable to everyone.

Oil-basal 2,4-D and 2,4,5-T in the growing season is the most effective application to produce dead brush in more species. The quantity applied is less than in broadcast operations, and it preserves desirable low ground cover for game and appearance. It also keeps out seedlings of undesirable brush which could start in areas made bare by broadcast applications.

Dormant 2,4-D and 2,4,5-T or all 2,4,5-T applications are also selective and effective. Experience indicates that they are more expensive and less effective than summer basal because working conditions are not so ideal; more brush is missed because of recognition difficulty; and single canes and seedlings are either passed by, or it is too costly to search them out.

Ammate is an effective broadcast spray on brush when used in quantity and at proper dilutions. It provides greater protection against drift damage than 2,4-D or 2,4,5-T but is more severe on desirable ground cover.

All of these applications will kill brush. Some will kill more than others. Discouraging results are not the fault of the chemical but are experienced when someone attempts to kill 8 to 16-ft brush with a spray application intended for 4-ft brush. Using a broadcast water application on species it will not kill, expecting perfect brush elimination from one application, or seeking quality work on a low competitive dollar basis all contribute to unsatisfactory results.

Chemicals for brush control work will probably be improved, and experience should lead to better application. But even now it costs less to kill brush with chemicals than to cut it, and chemicals keep the right-of-way in far better condition. Efficient spraying usually costs less than any other treatment to produce better rights-of-way.

Trimming Is Different

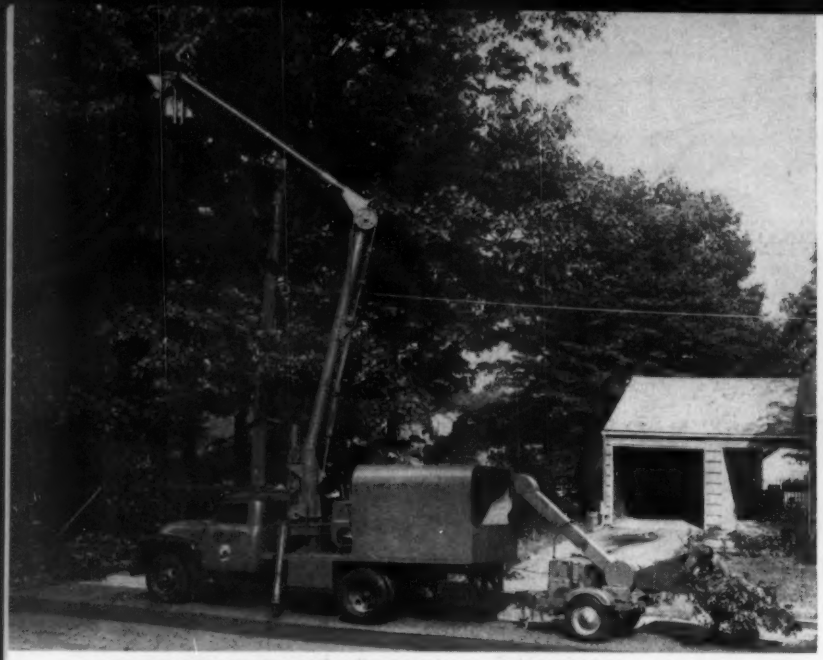
Tree trimming is a different problem because it involves removing undesirable tree growth from the vicinity of energized wires. It involves knowledge and skill at tree surgery to assure that the trees will remain in condition. And to hold skilled manpower work must go on throughout the year.

Tree clearance progress stems from:

1. Better training in arboriculture and line-work methods.

2. Better transportation equipment, such as the skyworker to expedite access to overhanging limbs.

3. Power-driven tools, such as saws to speed heavy cutting, chippers to compact cuttings for disposal, the telescoping boom for safe removal of trees that are too dangerous to climb,



MOBILE EQUIPMENT SPEEDS TRIMMING. Boom positions trimmer among branches; groundman feeds cuttings to chipper which loads residue in truck for disposal

and special hand tools for trimming.

All these have been designed with one thought in mind—to do the job cheaper and better.

Good supervision has markedly cut the cost of line clearance and improved the work done. Because crews are often on their own, closer supervision aids all aspects of the job by:

1. Keeping a supply of sharp tools always available.

2. Reducing labor turnover through closer contact and better training.

3. Improving coordination between tree crews and the utility to achieve better circuit performance.

4. Obtaining better appearance and maintenance of truck, chipper, and other equipment used on the job.

5. Reporting work more accurately and holding men on the job.

6. Promoting contact with tree authorities to improve public relations.

7. Supervising work to improve the safety record. Insurance is the highest item after direct labor.

Recognition of the fundamentals of tree structure and growth provides better quality work as well as longer-lasting wire clearance. Good flush cuts, cutting to laterals, recognition of growth rate and form, removal of overhangs, and use of tree paint may cost more the first year than leaving stubs, unpainted cuts, and "round-overs." But good initial trimming pays dividends in low-cost re-trimming and longer trimming cycle. Correct methods provide permanent futuristic clearance for less money and help prevent complaints about butchery, sunscald, and decayed stubs.

Plant expansion, rising labor costs, and demand for better work and fewer service interruptions have boosted line clearing costs considerably. But no practical and economical substitute for tree clearing can be foreseen. The only hope of economy lies in using trained specialists under close supervision who use highly mechanized methods to get longer lasting clearance.

Hydraulic Boom Aids Mid Span Work

PAUL SCHMIDT, Safety & Training Supervisor, Electric Distribution Dept, Cincinnati Gas & Electric Co., Cincinnati, Ohio

Clamping extension ladders to the hydraulic boom of a line truck has enabled line crews of Cincinnati Gas & Electric Co to do many jobs which otherwise would require an aerial ladder or platform truck to handle them safely. This practice resulted from the need for a temporary arrangement to do aerial work. Jobs handled in this manner include mid-span taps, adjustment of installation of street light fixtures, and repair of primary lines at some distance from a pole. Attachments are welded permanently to the boom, and the ladder is installed and removed with the boom lowered.

Safety precautions require that the ladder be extended no more than six rungs above the sheave of the boom. The lineman attaches a safety line to the head of the boom and stands no higher than the second unsupported rung. Standing on the second rung insulates him from ground. The boom is erected to an angle where the sheave does not extend horizontally more than 12 ft beyond the bed of the truck.

Progress in turbine generators

How General Electric provides maximum reliability in turbine-generator armature insulation

About preceding page illustration

HIGH-VOLTAGE TESTS TO DESTRUCTION are used to determine how much G.E.'s armature insulation can withstand. Forced to carry voltages far above their rating, test bars first develop corona streamers, then finally fail, enabling engineers to discover the insulation's actual voltage strength.

99.85% service availability highlights performance of turbine-generator armature insulation

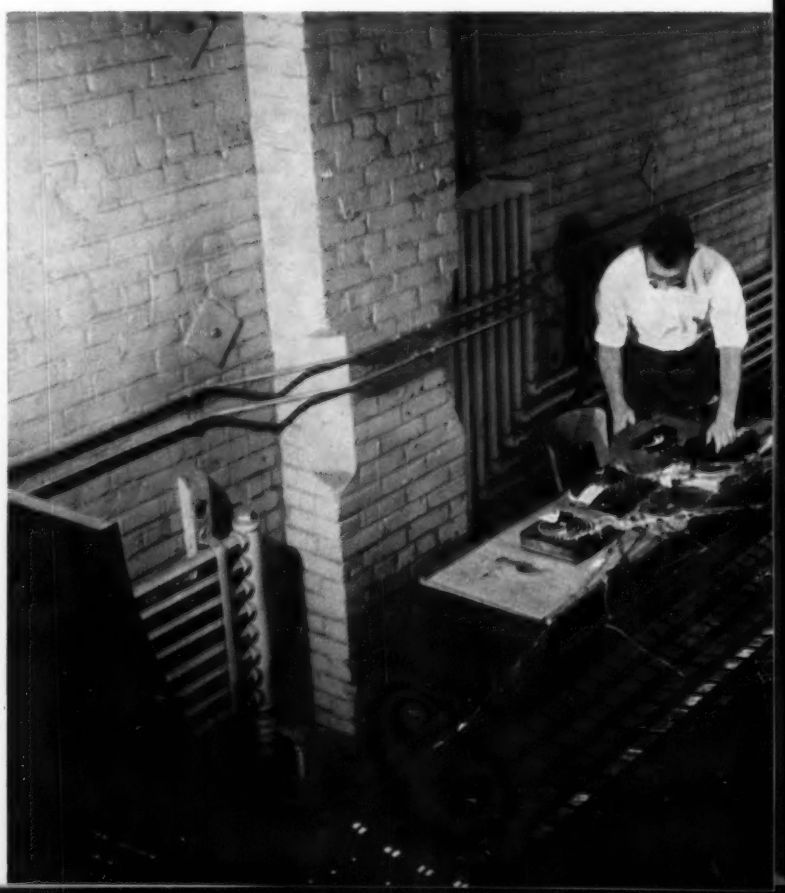
G-E design combines both electrical endurance and mechanical toughness

Primary among the many factors affecting a turbine-generator's long-term service availability is the quality of its armature insulation. It must withstand high voltages over long periods of time. And at operating temperatures it must endure the variable stresses caused by differential thermal expansion and contraction within the generator.

General Electric insulation measures up to these requirements with an already proved service availability of 99.85 percent in turbine-generators.

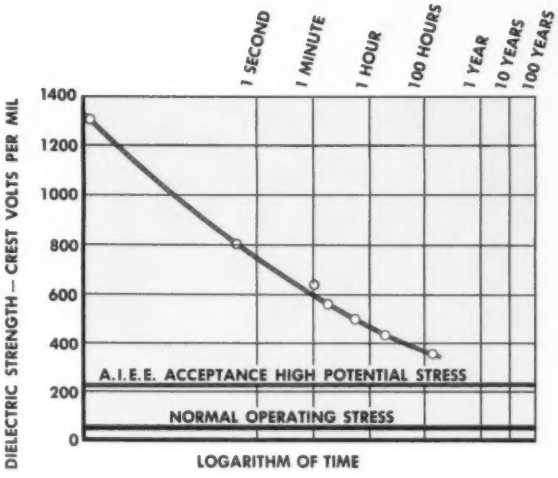
Progress in other areas of generator development often influences the performance of insulation. Larger capacities, higher voltages, different cooling methods all present new problems. To make sure that insulation quality keeps pace, each new generator development includes rigorous tests of insulation under the new set of conditions.

The illustrations on these pages show typical insulation tests constantly under way at General Electric's turbine plant.



G-E APPLIED RESEARCH is typified by this full-size armature bar test. Here, General Electric engineers find out how well insulations can withstand the mechanical stresses caused by differential thermal expansion and contraction within an operating generator.

To simulate actual operation in this special 17½-foot core section, high currents are run through full-size stator conductors to build up heat; then are shut off while the apparatus is cooled by blowers. This procedure can reproduce ten years of anticipated operating stress cycles in just four months of testing. This important test provides an accurate means of evaluating both present insulation materials and new ones under development.



HIGH-VOLTAGE ENDURANCE of G-E insulation over long periods of time is graphically illustrated here. This record invites comparison with that of any other turbine-generator insulation in service today.

FLEXING TEST determines the insulation's ability to withstand bending caused by expansion and contraction or by short circuits. Here, a G-E engineer evaluates performance of the critical end portion of an armature bar.

EVERY GENERATOR leaving the factory has passed a series of searching high-potential tests. A sample bar, selected at random, is tested to failure. For quality control, each bar is separately subjected to voltage stresses of more than five times normal operating stress. When installed in the generator, the bar is again tested at voltages producing 3½ times normal operating stress. Immediately following generator running tests, windings are "hot high-potted" at operating temperatures, and finally tested at room temperature just prior to shipment.

Leader in Turbine-Generator Progress

GENERAL ELECTRIC

G-E engineers are developing new insulations for larger machines

In the picture above, a G-E development engineer is shown inspecting one of tomorrow's insulations now being developed in the Large Steam Turbine-Generator Department's Materials and Process laboratory. A special processing mill is being used to treat the new type insulating material. The rollers increase homogeneity and orient the structure for improved mechanical and electrical properties.

One of the new materials coming out of this applied research is Micapal, a mica-based synthetic insulation which shows marked improvements in dielectric strength, thermal conductivity, heat endurance, and mechanical strength. The first generator utilizing Micapal has been in commercial operation for more than two years.

Micapal and other insulations now under development will help continue General Electric's record of turbine-generator progress.

If you would like more information on G-E turbine-generator development, contact your nearest G-E Apparatus Sales Office, or write for Bulletin GER-1047, "Research and Development in the Field of Turbine-Generator Prime Movers in the General Electric Company." Large Steam Turbine-Generator Department, *General Electric Company, Schenectady 5, N.Y.*

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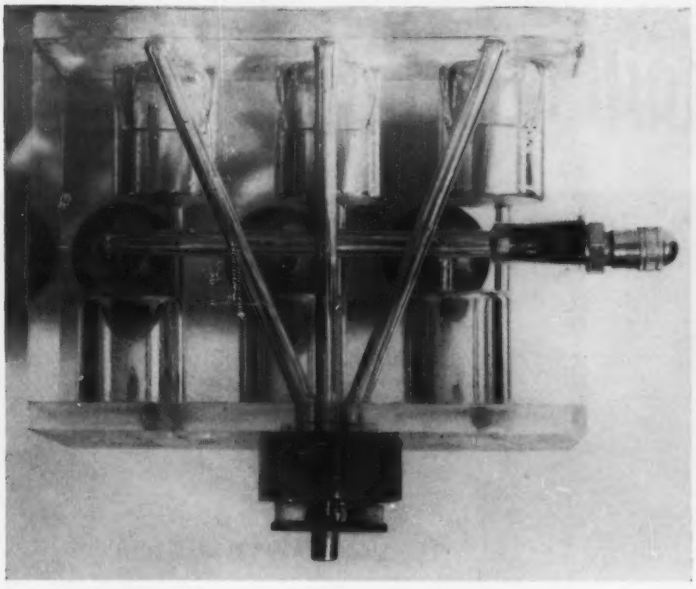
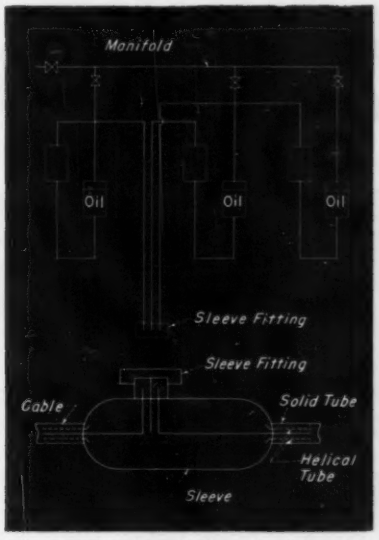
Progress Is Our Most Important Product

GENERAL ELECTRIC





GAS BUBBLES forced through oil in cylinders indicates the leak in cable section

DISTRIBUTION—Maintenance

Detectors Spot Leaks in LP Gas-Filled Cable

JOHN D. OLIPHANT, Staff Engineer, Underground Distribution, Department of Water & Gas, Los Angeles, Calif.

Two types of leak detectors are saving considerable time in locating small, slow leaks in low-pressure, gas-filled, lead-covered cables on the Department of Water & Power's distribution system. Their use eliminates the long and tedious opening of manholes, removal of tile or fireproofing, and application of soap suds and/or a liquid plastic solution to fittings and wipes. On a line of 50 manholes, the detectors do in a matter of hours a job that formerly engaged a two-man crew for at least ten days.

To date the detectors have helped find 15 leaks on seven lines. Pressure loss on these lines before location and repair varied from ½ to 2 lb in 16 hr. The line remained in service. Low spots due to difference in elevation, which restrict the flow of gas through helicals, posed no problem.

The hydrostatic detector, in use for about a year on 34.5-kv gas-filled cables, is adaptable to cable systems in which the solid gas tube is brought out at the joint wipe. Developed by department employees, a working unit was made by L. W. Wallace, underground superintendent. Its basic working part is made from a lucite block in which are three groups of drilled wells or cylinders. There are two cylinders per group with one cylinder in each group connected from the top into a common tube (manifold) which can be connected through a Schroeder valve to an external gas source. The other cylinder in each group is connected from the top into a common fitting attached to the sleeve joint.

Emits Bubbles

By connecting the common fitting with its three tube openings to the sleeve boss, a separate set of cylinders is connected to the gas tube in the section of cable on each side of the sleeve. The third set of cylinders is connected to the sleeve itself and to related helicals. Each set is joined at the bottom by a drilled interconnecting passage. To isolate each set from the others, the manifold is sectionalized by valves in the manifold.

The detector operates on the difference of gas pressure between two points on each side of a set of cylinders. A pressure differential forces gas through the cylinders, each of which is about two-thirds filled with a good grade of cable oil. A pressure differential causes oil in one cylinder to be transferred to the adjoining cylinder and gas bubbles to be emitted. The bubbling is observable in either or both of the other lower cylinders. Inspection of the tubing arrangement indicates direction of gas flow, thus identifying the leaking cable section.

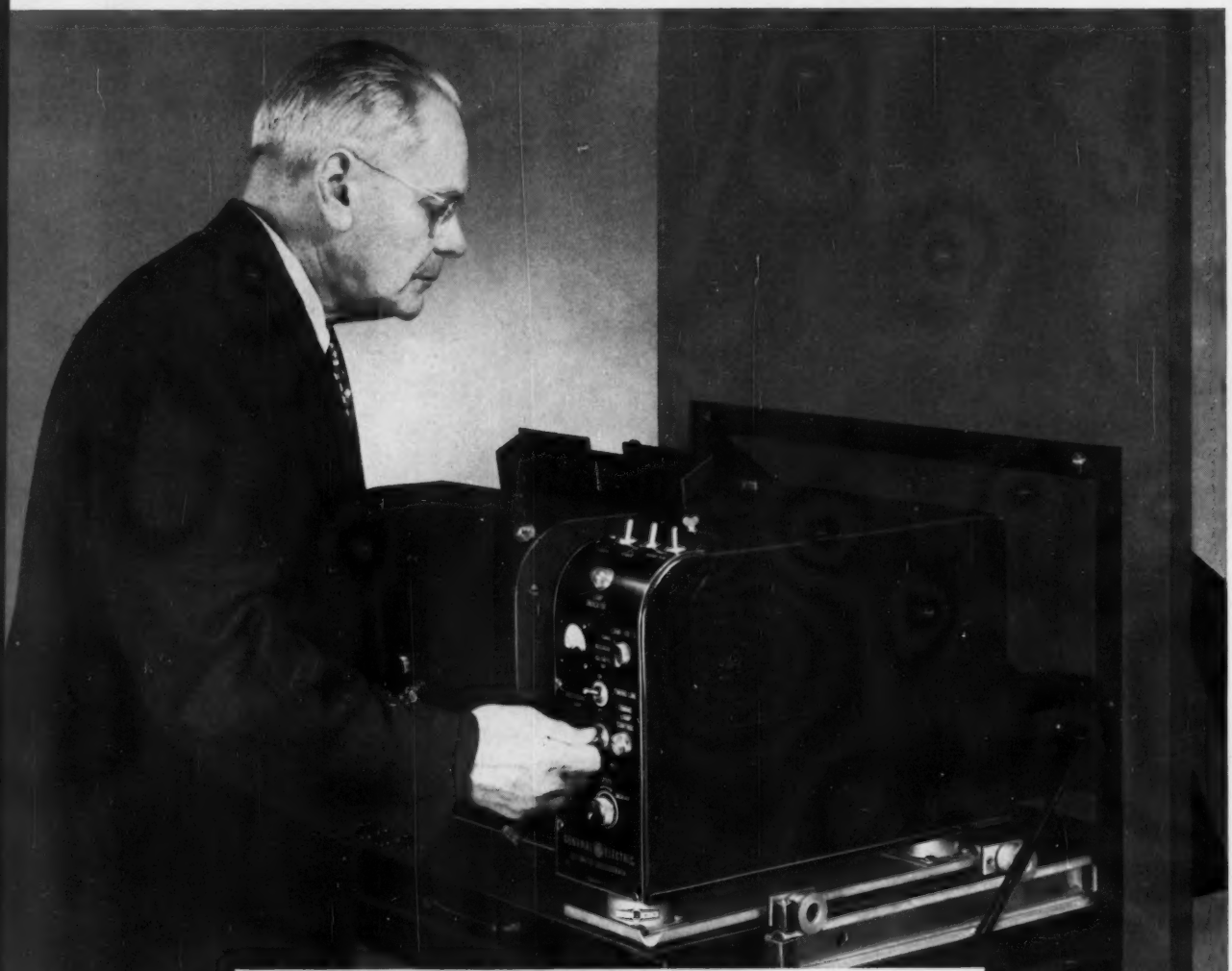
The diaphragm detector consists of a single chamber divided by a thin rubber diaphragm. It is attached to the cable sleeve in place of the clamping nut, and the center hole to the sleeve is blocked off. The detector is thus connected to the copper tubing feeding both ways from the joint. Pressure is then equalized through filling valves. As a pressure differential builds up, the diaphragm expands toward the leak. To detect slow leaks, the device may be left installed for hours without injury to the cable.

To locate a leak this detector is installed at the center of the cable. It is then moved half way between the center and the end having the leak. The process is continued until the leaking section is found. The method saves 90% in man-hours.

(*More How To on page* 100)

GENERAL ELECTRIC ANNOUNCES

22-Channel Oscillograph; Provides



PM-21 Oscillograph's Roll-out Chassis Saves Time, Reduces Cost of Operation and Maintenance

With the PM-21's exclusive roll-out chassis, you just ROLL OUT THE OSCILLOGRAPH—the sides, rear, and all parts are readily accessible for quick, easy operation and maintenance. Roll it in and the oscillograph is conveniently out of the way and protected by a metal door. A trouble light and operation counter show on the door.

ALL CONNECTIONS ARE IN THE REAR of the oscillograph, and quick-disconnect-type connectors permit easy removal for general-purpose use.

FOR MORE INFORMATION, contact your nearest G-E Apparatus Sales Office or write for bulletin GED-3049 to Section 585-32, General Electric, Schenectady 5, N. Y.

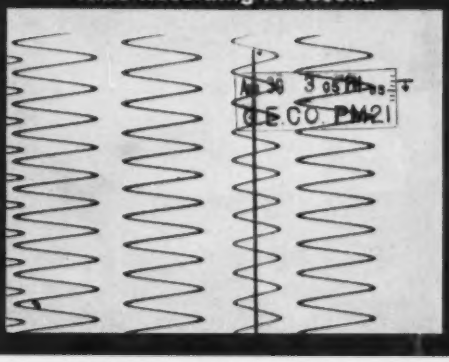
GENERAL ELECTRIC

New Versatility, Economy Features

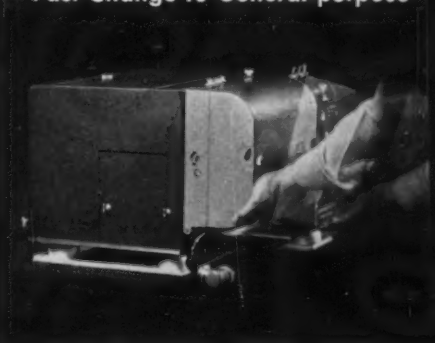
Fully-automatic Oscillograph Answers Utilities' Need for Greater Galvanometer Versatility, Easier Maintenance and Service, and Quick Change to General-purpose Use

22 Channels

Time Recording to Second



Fast Change to General-purpose

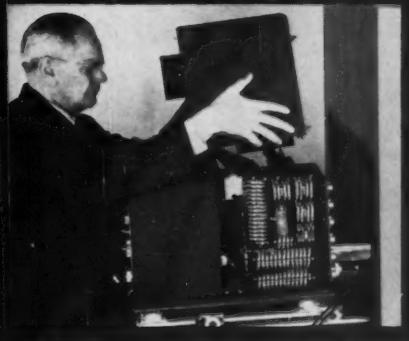


GREATER GALVANOMETER VERSATILITY is provided—holds from 1 to 22 bifilar galvanometers, or 11 to 18 bifilar plus 14 to 60 pencil-type galvanometers.

NO DECODING IS NECESSARY, and you get time recording to the second at the end of each record. A station identification nameplate can also be added for photographing on the record.

FOR STAGED TESTS, replace automatic record-paper holder with general-purpose holder to get continuously variable paper speeds of 4–500 feet/min.

Easy-access Design



Easy Access to Lamps

Separate Paper Holders

QUICK ACCESS TO ALL VITAL PARTS is provided by hinged doors in the case. For complete access, loosen 3 fasteners and entire cover can be removed.

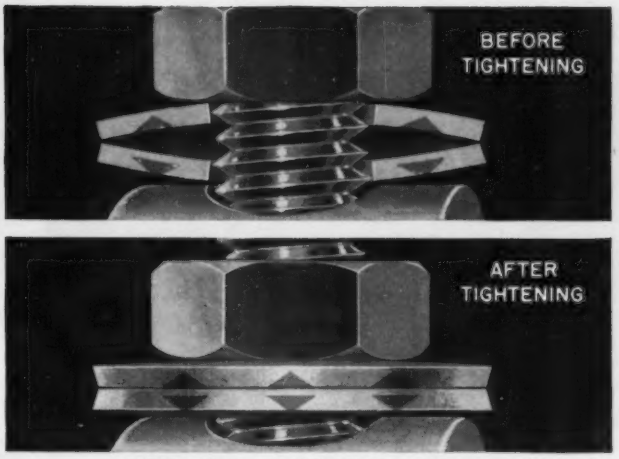
LAMPS ARE EASILY ACCESSIBLE for replacement. Remove record holder, and lamp holders swing out for simple removal. Anyone can replace lamps since no optical adjustments are needed.

2 PAPER HOLDERS (lower for exposed; upper for unexposed) allow removal of lower holder to darkroom. A spare replaces it for continuous operation.

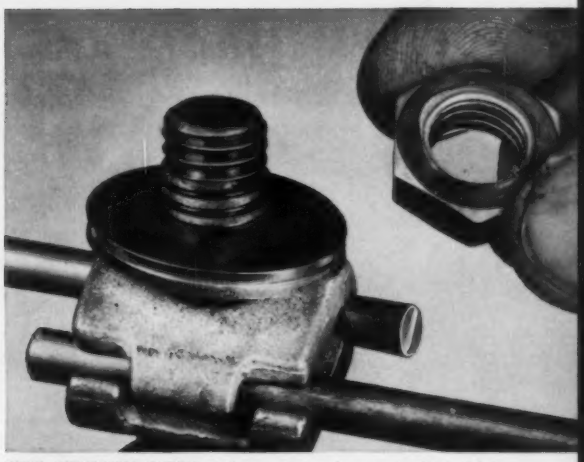
Progress Is Our Most Important Product

GENERAL ELECTRIC

DEMONSTRATION OF CLAMPING ACTION of G-E Capacitor Terminals shows how Belleville washers flatten after proper wrench torque—maintain 1000-lb pressure. Aluminum and/or copper conductors are held securely even if "cold flow" should occur.



1000-LB SPRING ACTION through compression of Belleville washers. Flattened washers indicate sufficient torque.



STUD STRIPPING ENDED with easy-to-replace nut which strips first if too much torque is applied.

G-E CAPACITOR TERMINALS MAINTAIN LASTING CONTACT

Field-proven assembly compensates for "cold-flow" and eliminates terminal stud stripping

Quick, lasting connections can be made with G.E.'s capacitor terminal assembly. Linemen need only *flatten* the stainless steel Belleville washers with about 2 turns on the nut to securely clamp aluminum or copper conductors. That's because these washers convert 8 ft-lbs of torque to approximately 1000 lbs force on the parallel groove connectors. They also provide a "follow-up" action that compensates for aluminum "cold-flow," thereby maintaining lasting contact pressure.

STRONGEST ASSEMBLY on the market today, the G-E capacitor terminal stud has been subjected to tightening torques of over 70 ft-lbs without damage. If excess torque is applied, the threads on the nut, which has been designed as the weakest member of the assembly, will strip before those on the stud.

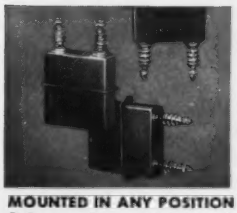
WIDE RANGE OF CONDUCTORS (AL/CU) from No. 2 to No. 9 AWG (stranded) or No. 10 AWG (solid), can be securely clamped with G.E.'s parallel groove connector. A conductor can be easily inserted without threading or removing any hardware.

ENGINEERED EXTRAS such as this new terminal combine to make General Electric capacitors the most practical . . . and economical unit for you. For complete information about them, contact your G-E Apparatus Sales Representative or write for bulletin GEA-6260, General Electric Company, Schenectady 5, New York. 441-28

Progress Is Our Most Important Product

GENERAL ELECTRIC

ONLY G-E CAPACITORS HAVE ALL THESE *Engineered Extras* AT NO EXTRA COST

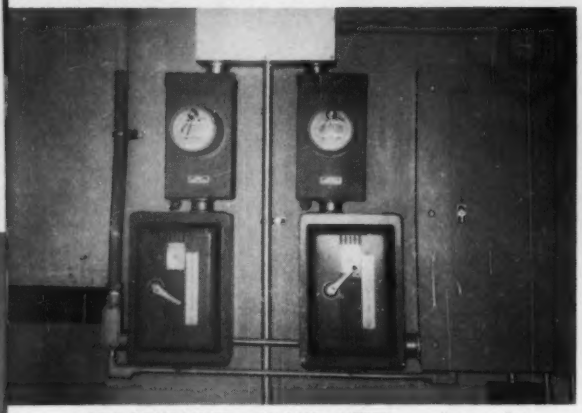


MOUNTED IN ANY POSITION G-E capacitors maintain uniformly high efficiency.

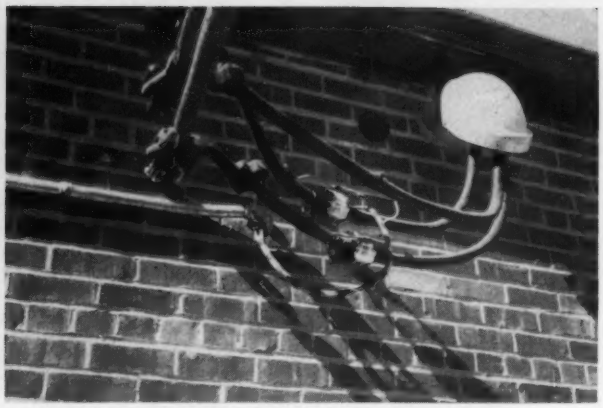
CORROSION-RESISTANT CASE, tin plated inside and outside, prolongs capacitor life.

SMALLER AND LIGHTER, than any other make, for easiest handling and installation.

EXTRA-STRENGTH BUSHINGS, welded then soldered to case, maintain hermetic seal.



SELF-CONTAINED, 50-AMP METER on heavy-duty mounting is for customer loads ranging up to 200 amp



"DO-NUT" CURRENT TRANSFORMERS are on drip loops of services. Lighter type is for 200 to 400 amp

Design Heavy-Duty Metering Installations

METERS are mounted in most cases on exterior walls of buildings

L. W. JONES, Superintendent of Meters Kansas City Power & Light Co, Kansas City, Mo

Several types of metering and service installations, developed by the Kansas City Power & Light Co, have reduced costs to both customer and company.

For customers having an entrance switch of 200 amp, a heavy-duty mounting device and a modern 50-amp, self-contained meter are used. This installation is used on 3-wire, single-phase, 3-wire, 3-phase, and 4-wire, 3-phase services. On 4-wire services, a 2½-element meter is used.

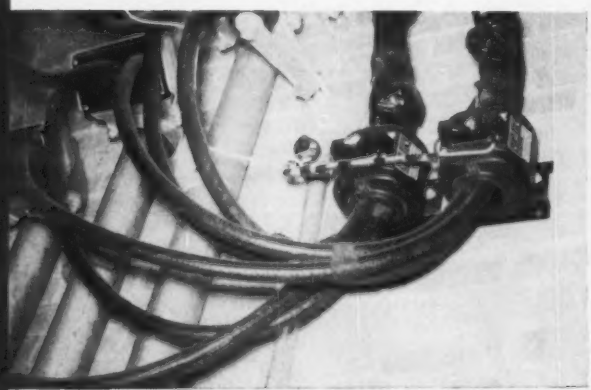
Where the customer's entrance switch is above 200 amps, "do-nut" type current transformers are used. Where the small-dimension, 400-amp transformers are applicable, they are merely slipped over the drip-loops of the customer's service. In most instances the meter is mounted on the outside wall. Some customers have requested that the meter be installed on the inside wall.

Interruptions Minimized

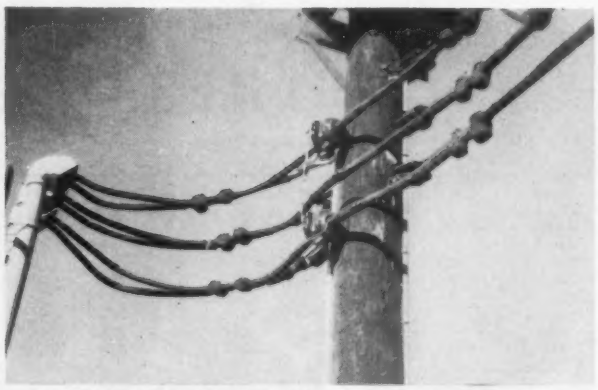
For larger loads, a heavier-duty "do-nut" current transformer is installed on the drip loops of the service. Because of its greater weight, it is fastened to the wall, or to a pole.

Besides their low cost, these installations often permit changes and maintenance work without interruption to the customer's service.

(*More How To on page* 104)



HEAVY "DO-NUT" for loads above 400 amp is over drip loops but fastened to wall for support



ALTERNATIVE INSTALLATION has heavy "do-nuts" supported by pole. Changes don't cause interruption

3 BIG REASONS WHY YOU'LL WIN WITH FARGO AUTOMATIC LINE SPLICES *for ALUMINUM and COPPER*

1 — THEY'RE PERMANENT . . . all the parts equal or surpass the weather-ability of conductors . . . connections have full strength of the wires . . . provide joint resistance lower than equal length of conductor

2 — THEY'RE SAFE . . . require no extra tools to install . . . ample safety zone at back of jaws readily accommodates burred ends of wire assuring full surface grip on conductors.

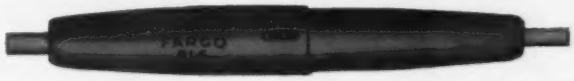
3 — THEY'RE ECONOMICAL . . . automatic one-piece jaw assures quick, easy installation . . . sag guide helps linemen sag lines properly . . service records prove their lower over-all cost!

EXCLUSIVE 1-PIECE JAW CAN'T GET OUT OF ALIGNMENT

The heart of every Fargo Automatic Line Splice is this exclusive one-piece jaw machined from solid bar stock. In contrast to other types composed of four or more parts, this unique unit simply cannot get out of alignment. From the first all-important grip every installation step is quick and positive — saves time and costs. Jaws for all aluminum and AAAC splices machined from special aluminum alloys.

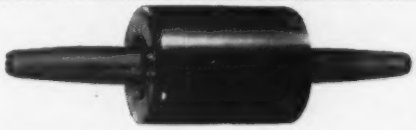
Ask your Line Material Field Engineer for complete details.

LS Series — for straight line splicing



RLS Series — for splicing conductors of different sizes.

ALS Series — for straight line splicing — Aluminum
NDLS Series — for straight line splicing — AAAC



SFT — SFO Series for series street lighting and secondary breaks

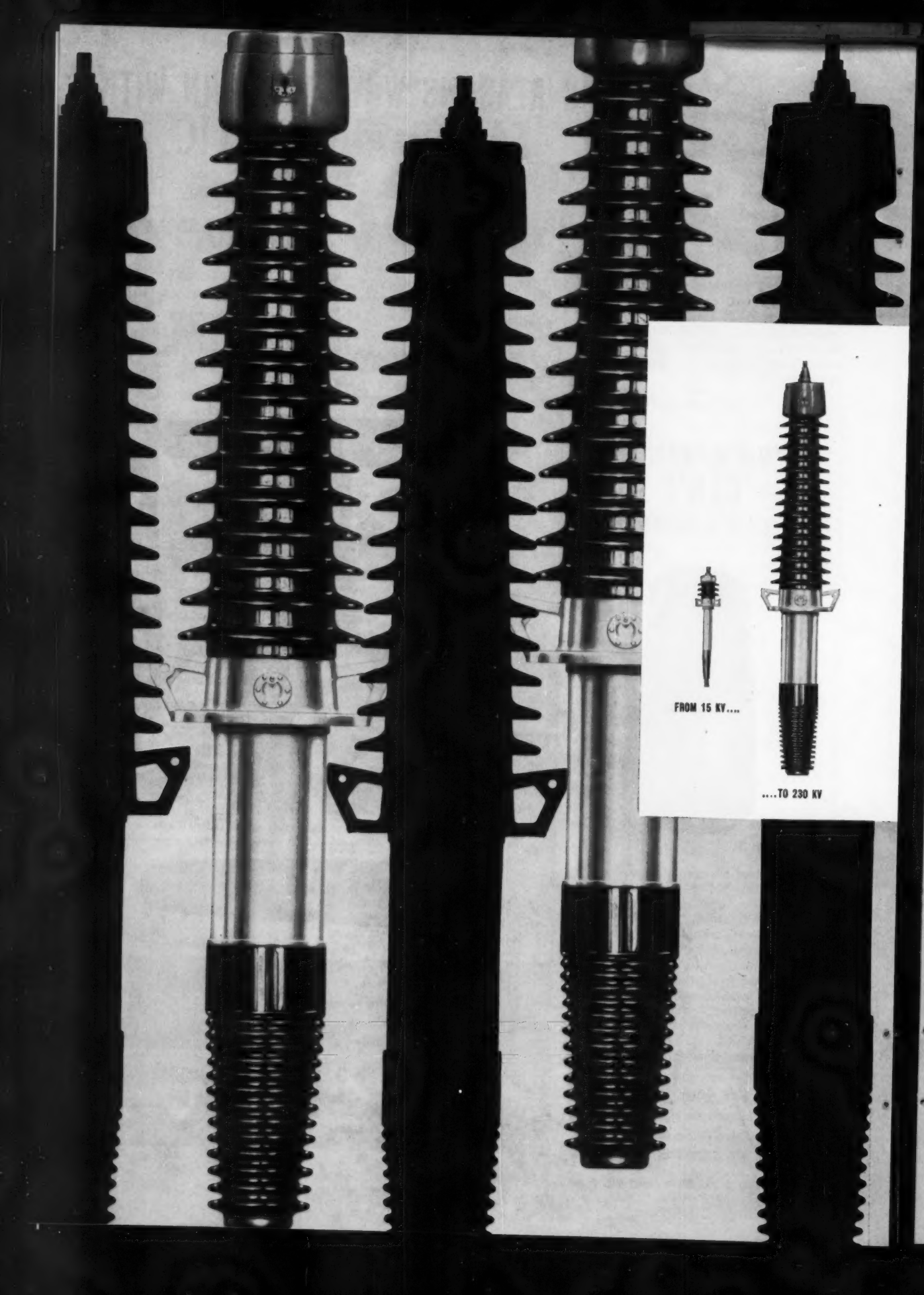
AMS Series — for splicing Copperweld guys and messengers.

Manufactured by
FARGO MFG. COMPANY, INC.
Poughkeepsie
New York

FARGO

Distributed by
LINE MATERIAL COMPANY
(A McGraw Electric Company Division)
Milwaukee, Wisconsin

LM


FROM 15 KV....
....TO 230 KV

NEW O-B BUSHING

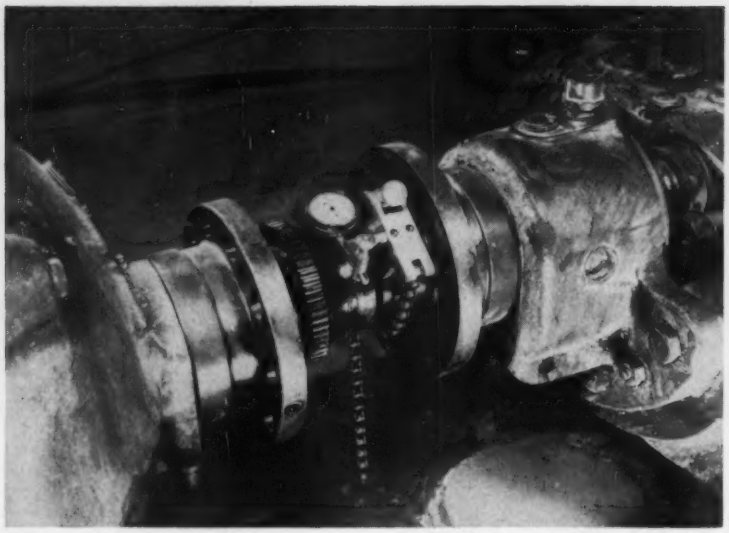
WORKS ALL THE INSULATION . . . OVERWORKS NONE OF IT

Every new O-B bushing, all the way from 15 to 230 kv, uses "full condenser" construction of the insulating core. Concentric foil layers, acting as plates, decrease in length as they increase in diameter in order to maintain uniform area. During the paper winding operation, spacing of these plates is held to a high degree of accuracy . . . In a condenser where plate area and dielectric spacing are equal, voltage is uniformly divided. In this way, the total bulk of insulation in the O-B bushing worked efficiently; each dielectric zone taking an equal share of the voltage, and subjected to extremely conservative stress . . . This permits combining the slender form of O-B's new bushing with high operating reliability and generous safety factors at all voltage ratings . . . These bushings are now available for application to your new station equipment.

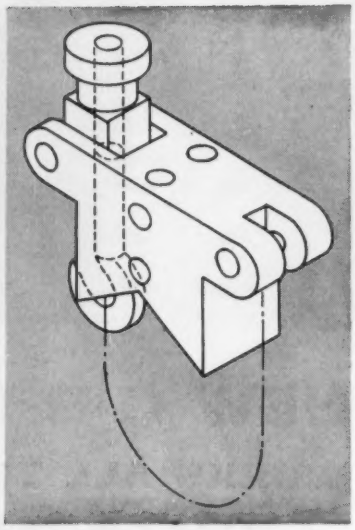
4641-H

Ohio Brass

MANSFIELD OHIO, U. S. A.



CLAMP secures the dial indicator to nearly any size shaft for checking shaft alignment. It facilitates placing and locking the indicator on exposed faces



CLAMP consists of "V" block with holes drilled, tapped on shaft axis

Clamp Dial Indicator For Aligning Shaft

GERALD HICKS, Machinist, White River Plant, Indianapolis Power & Light Co., Indianapolis, Ind.

A clamp has been designed to provide the machinist with a quick and simple method of setting up a dial indicator for checking shaft alignment to facilitate placing and locking the indicator on any of the three exposed faces. A piece of small roller chain is attached to one end of the block. The chain is run around the shaft and placed in a hook which is threaded and equipped with a knurled knob so that it snugs the clamp to the shaft.

This device saves Indiana Power & Light machinists considerable time.

TRANSMISSION—Maintenance

Horse Lifts Transmission Pole Easily to Position for Framing

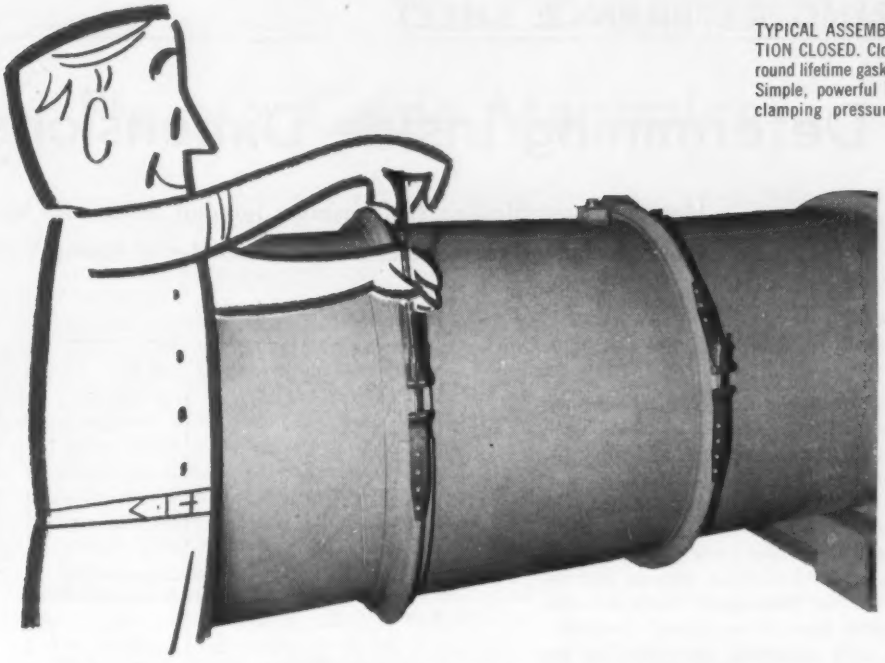
ROY LIFLER, Transmission & Distribution Maintenance Dept., British Columbia Electric Co, Vancouver, B. C.

Poles are held off the ground for faster framing on a framing horse used by British Columbia Electric Co. The simple device is easy to use and holds the pole firmly and conveniently.

The horse consists of a length of crossarm cut diagonally at one end. At the other end are two metal legs and a lifting handle. The horse is placed perpendicular to the pole with the legs flat on the ground. Then the pole is rolled onto the horse and a length of pipe is placed in a hole behind the pole. The length of the horse provides sufficient leverage to allow lifting it and the pole until the legs swing into near vertical position.

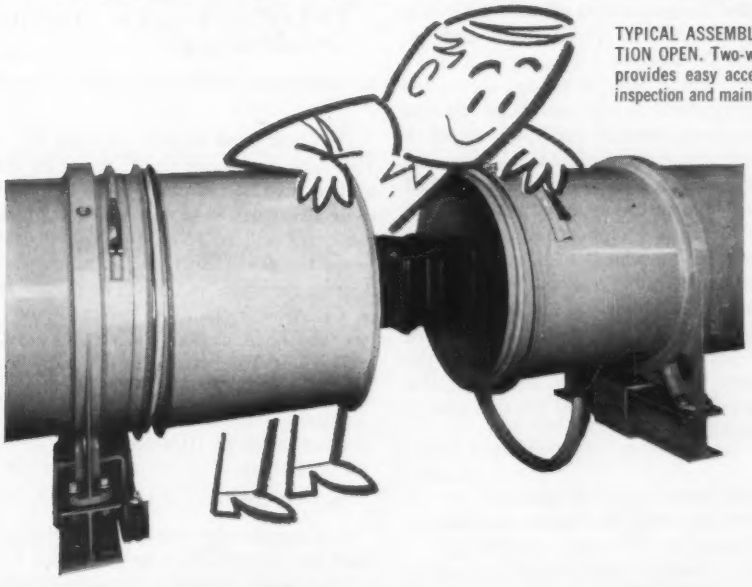
Cost of the framing horse, including labor for attachment of legs and handle, is about $15.

(*More How To on page* 108)



TYPICAL ASSEMBLY WITH TELESCOPING SECTION CLOSED. Closure requires only two 1-piece round lifetime gaskets—easy to place and remove. Simple, powerful V-clamp couplings distribute clamping pressure uniformly around the ring.

New design of I-T-E Isolated Phase Bus



TYPICAL ASSEMBLY WITH TELESCOPING SECTION OPEN. Two-way sliding telescoping section provides easy access to connectors—simplifies inspection and maintenance.

simplifies installation and inspection

All-welded aluminum basic assemblies—joined together with 2-way sliding telescoping sections—cut installation and inspection time. A V-clamp closure and a 1-piece round gasket in each telescoping section joint assure a permanently tight seal. This new design reduces gasketing 75%. In addition, it combines great strength and light weight with structural simplicity. And smooth inside surfaces prevent the accumulation of moisture.

Bulletins 10004-A and 10004-B describe I-T-E Isolated Phase Bus designs. For copies of these bulletins, write I-T-E Circuit Breaker Company, 19th and Hamilton Sts., Phila. 30, Pa.

I-T-E CIRCUIT BREAKER COMPANY • Switchgear Division

Determining Inside Dimensions

DISTRIBUTION
Design

Method of establishing the minimum internal dimensions and space design of rectangular-shaped manholes is exemplified.

DONALD W. BOSWORTH,
Electrical Division, J. G. White Engineering Corp, New York, N. Y.

Manholes in underground electrical duct systems are designed to provide primarily for: Draw-in of cables, housing for splices, points for circuit junctions, and space for longitudinal expansion of cables.

Cable installation requirement is usually satisfied if a minimum of 6 ft is provided in line with each duct entrance to accommodate sheave stands and cable pulling rigging. Space is required for the finished splice, plus an addition for straight cable equal to the splice sleeve length to permit slipping the splice sleeve back during taping operations. Space provisions for cable expansion must allow for the cable to be trained cold so that cable bends will not exceed minimum radii at maximum operating temperature.

A provision for cable expansion is to off-set a cable in a reverse bend (Fig 1) between the duct opening and the first point of support in the manhole.

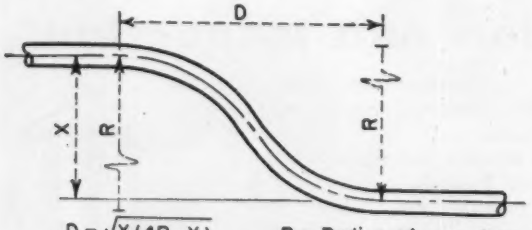
In corner manholes, where cable is trained through a 90-deg bend, a change in elevation will provide an effective expansion loop. A compound bend of this type is shown in Fig 2. Trigonometric functions required to determine the dimensions of this type of cable bend are graphed in Fig 3. Where the cable must be supported between such a bend and the duct mouth, the support must permit the required longitudinal cable movement without restriction.

An example is given to determine manhole inside dimensions. Fig 4 shows an exploded view and a location plan of a corner manhole. The north-south duct bank is located within 26-in. of the east wall, due to subsurface interferences. The 4-in. ducts will be on 6-in. centers. Cable shown in the manhole will be the limiting size and type to be installed in this system.

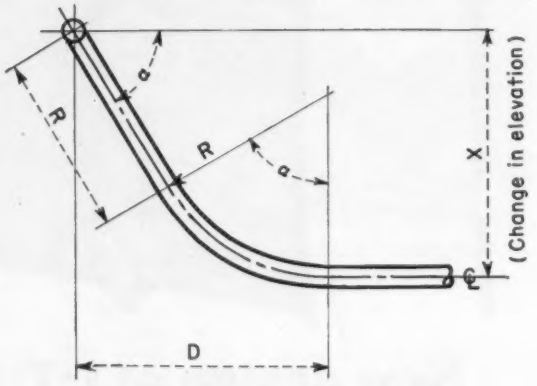
Design of Manhole

1. Determination of dimension E—length.

1a. Distance between the north duct mouth and PC_1 is to be 3 in. minimum.



1. REVERSE BEND serves as expansion loop for cable.



$X = R + R(\sin\alpha - \cos\alpha)$ $D = R(\sin\alpha + \cos\alpha)$
α = Central angle

2. COMPOUND BEND adds elevation to expansion loop.

1b. Cable bend between PC_1 and PT_1 is a reverse bend. The cable and splice sleeve are to be 9 in. from the east wall to provide clearance for arc-proofing. Assuming the splice sleeve will be in 4-in. OD, the horizontal offset of this cable, X_h, will be 15-in. If a future cable is installed between the center duct on the north wall and the bottom duct on the south wall it will be racked across the manhole in a horizontal plane. As cables should not be racked on less than 12-in. centers, the vertical offset, X_v, of this bend will be 6-in. Total offset, X_1, may now be determined.

$$X_1 = \sqrt{X_h^2 + X_v^2} = \sqrt{15^2 + 6^2} = 16 \text{ in.}$$

Assume the cable is 2-in. OD and has a minimum bending radius of 10 times OD, or 20-in.

Curve distance for the cable when hot is:

$$D_{1H} = \sqrt{X_1(4R_H - X_1)} = \sqrt{16(4 \times 20 - 16)} = 32 \text{ in.}$$

A comprehensive method of evaluation of cable movement due to cyclic loading by authors C. A. Bauer and R. J. Nease was published in the January 1954 issue of Electrical Engineering (AIEE). For the example, assume cyclic cable movement obtained by this method is 3-in.

Assuming the cable offset will remain constant during the cyclic movements (not necessarily true), the cable curve distance (between PC_1 and PT_1) for the cold condition is:

$$D_{1C} = D_{1H} + 3 \text{ in.} = 32 \text{ in.} + 3 \text{ in.} = 35 \text{ in.}$$

Minimum shaping radius for the cold cable is:

$R_{1C} = (D^2_{1C} + X_1^2)/4X_1 = (35^2 + 16^2)/4(16) = 23.2$ in.

This dimension should appear in cable racking instructions.

1c. Distance from PT_1 to cable rack (a) is to be 6 in. minimum.

# of Electric Cable Manholes

1d. Dimension B is summarized: From Par. 1a, distance = 3 in.; Par. 1b, curve distance = 35 in.; Par. 1c, distance = 6 in. Total = 44 in.

1e. Determining the required distance between dimensions B and C:

Distance between rack (a) and splice = 6 in.; length of splice sleeve = 24 in.; (Splicing operations will require nearly 24 in. of straight cable to slip back the splice sleeve; allow 18 in. north of rack (b) and 6 in. south of rack (a) for this purpose.) allow distance between splice and rack (b) = 18 in. Total = 48 in.

1f. Dimension C may be summarized:

Allow distance from rack (b) to PT_2 = 6 in.; cable bend is 90 deg with a radius = 20 in.; wall clearance + ½ cable OD = 10 in. Total = 36 in.

1g. Dimension E (length) may be summarized:

From Par. 1d, B = 44 in.; Par 1e, distance B-C = 48 in.; Par. 1f, C = 36 in. Total = 128 in. or 10 ft 8 in.

2. Determination of dimension F—width.

2a. Wall clearance + ½ cable OD = 10 in.

2b. Cable bend between PT_2 and PC_2 will be compound bend (see Fig 2) with a 6-in. drop in elevation to provide 8-in. clearance between the bottom of the bottom duct on the south wall and the top of the cable.

$$X_2 = R_H + R_H (\sin \alpha - \cos \alpha)$$

$$6 \text{ in.} = 20 + 20 (\sin \alpha - \cos \alpha)$$

$$\text{Sin } \alpha - \text{Cos } \alpha = (6 - 20)/20 = -0.7$$

From Fig 3: α = 15 deg, and $\sin \alpha + \cos \alpha = 1.21$

Now D_H, D_C and R_C may be determined:

$$D_H = R_H (\sin \alpha + \cos \alpha) = 20 (1.21) = 25 \text{ in.}$$

$$D_C = 25 \text{ in.} + 3 \text{ in.} = 28 \text{ in.} = R_C (1.21)$$

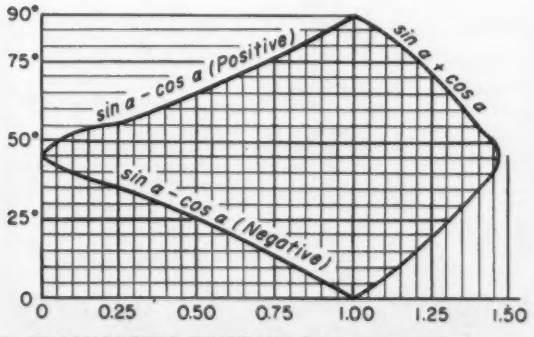
$$R_C = 28 \text{ in.}/1.21 = 23.2 \text{ in., say } 24 \text{ in.}$$

2c. Distance from PC_2 to the rack is 6 in.

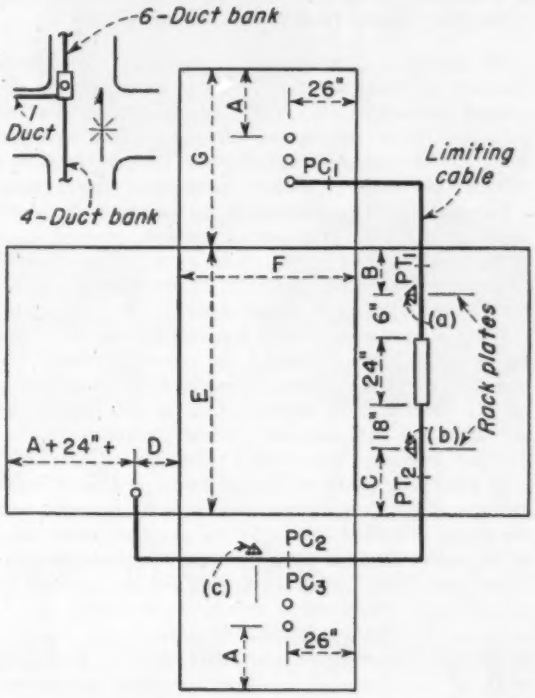
2d. As good practice, provide a minimum of 6-ft width for cable pulling operations when cable is installed in a side-walk duct.

2e. Summarizing the dimensions comprising the distance from the east wall to the rack:

From Par. 2a, distance = 10 in.; Par. 2b, curve = 24 in.; Par. 2c, distance = 6 in. Total = 40 in.



3. TRIGONOMETRIC FUNCTIONS for compound bend.



4. EXPLODED VIEW includes location plan for manhole.

2f. To provide 6 ft minimum for cable pulling, the west wall is to be 32 in. from the rack.

2g. Dimension F (width) may be summarized:

From Par. 2d, distance = 40 in.; Par. 2f, distance = 32 in. Total = 72 in. or 6 ft.

3. Determination of dimension G—depth.

3a. Dimension D is 18 in. minimum. This floor clearance is required for inspection and to clear cable pulling rigging.

3b. Distance between D and A has already been established as 24 in.

3c. When a future cable is installed between the top ducts on the north and south walls, it is to clear the future cable described in Par. 1b by 12 in. This cable will require 24 in. clearance from the manhole roof to provide room to fill a splice. Therefore dimensions A will be 30 in.

3d. Dimension G (depth) may be summarized:

From Par. 3a, D = 18 in.; Par. 3b, distance = 24 in.; Par. 3c, A = 30 in. Total = 72 in. or 6 ft. This is the minimum manhole height consistent with good practice.

4. Minimum manhole dimensions are now established as:

Length = 10 ft. 8 in.; width = 6 ft; depth = 6 ft.

Use of flared duct entrances reduces materially the required manhole inside dimensions.

Pulse-Timer Adjusts Governor Response Fast

GENERATION
Testing

Tests by Dayton P&L demonstrate pulse-timer is an effective tool facilitating determination of response characteristics

W. F. BLOOM, Test Engineer, Testing Section, Electrical Engineering Department, Dayton Power & Light Co, Dayton, Ohio

As automatic load-frequency control of generation translates a "recognized" demand for increased or decreased generation into control impulses to the turbine generator, these control impulses vary only with the demand. The impulses initiated are uniform regardless of which particular generator or generators receive them.

Consequently the governors of the various turbines are modified so that uniform control impulses produce equal changes in generator output. Such modification, essential to smooth and speedy operation of the control system, can be accomplished in various ways.

When a rheostat is used in conjunction with each control governor, its adjustment in accordance with the observed effect of demand changes, real or simulated, on the generation of each machine is time consuming and at best a trial-and-error method. Better results are obtained in shorter time with a pulse-timer.

In generating plants of Dayton Power & Light Co the contacts of the pulse-timer were connected in series with the source of control voltage for the governor motor relay or contactor. Impulses from the timer operated either the "raise" or "lower" relay, depending on the position of a single-pole, double-throw switch in the test setup. A recording wattmeter recorded the output of the machine whose governor response was under test. As generators at O. H. Hutchings station have individual wattmeters, a special wattmeter was not required.

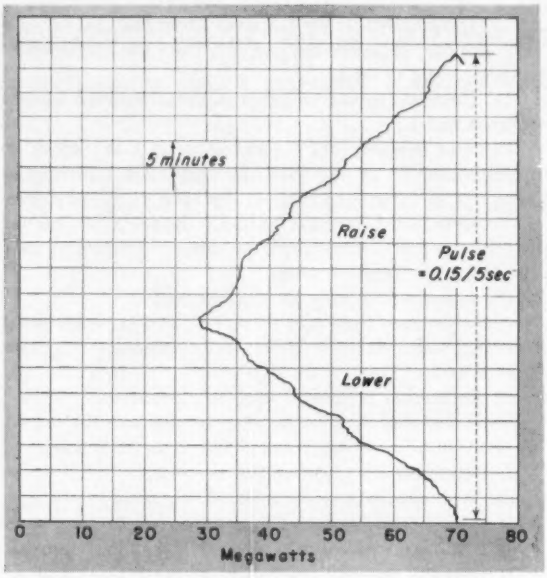
Slowest Response Determined

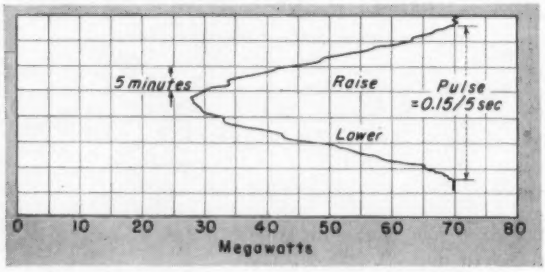
For the tests a pulse time of 0.15 sec every 5 sec was selected and was subsequently found to be only slightly greater than the minimum response time of the control system. Thus not only the "start" and "stop" time of the governor motor, but also the 'pickup" and "drop-out" time of the motor relay was taken into account.

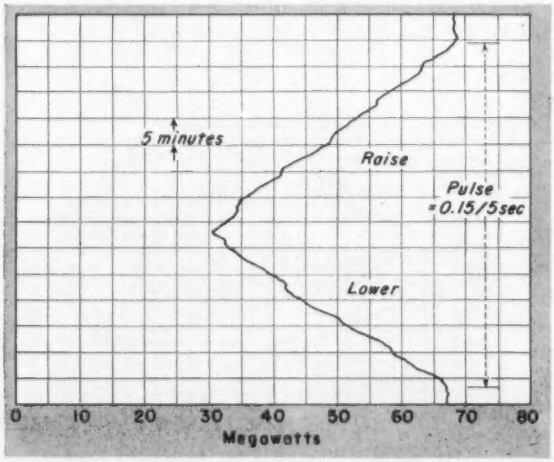
Through the use of short impulses ample time was allowed for steam generation to follow demands of the machines on which load was being changed and sufficient time was allowed for loading or unloading other units so that correct system generation could be maintained.

The curves obtained represent the unmodified charactertistics of the various units. Although designed and built as a pair, Unit 3 and Unit 4 had, respectively, the slowest and fastest responses. Once the machine with the slowest response had been determined, it was easy to adjust the rheostats of the other governors until uniform response curves were obtained for all units.

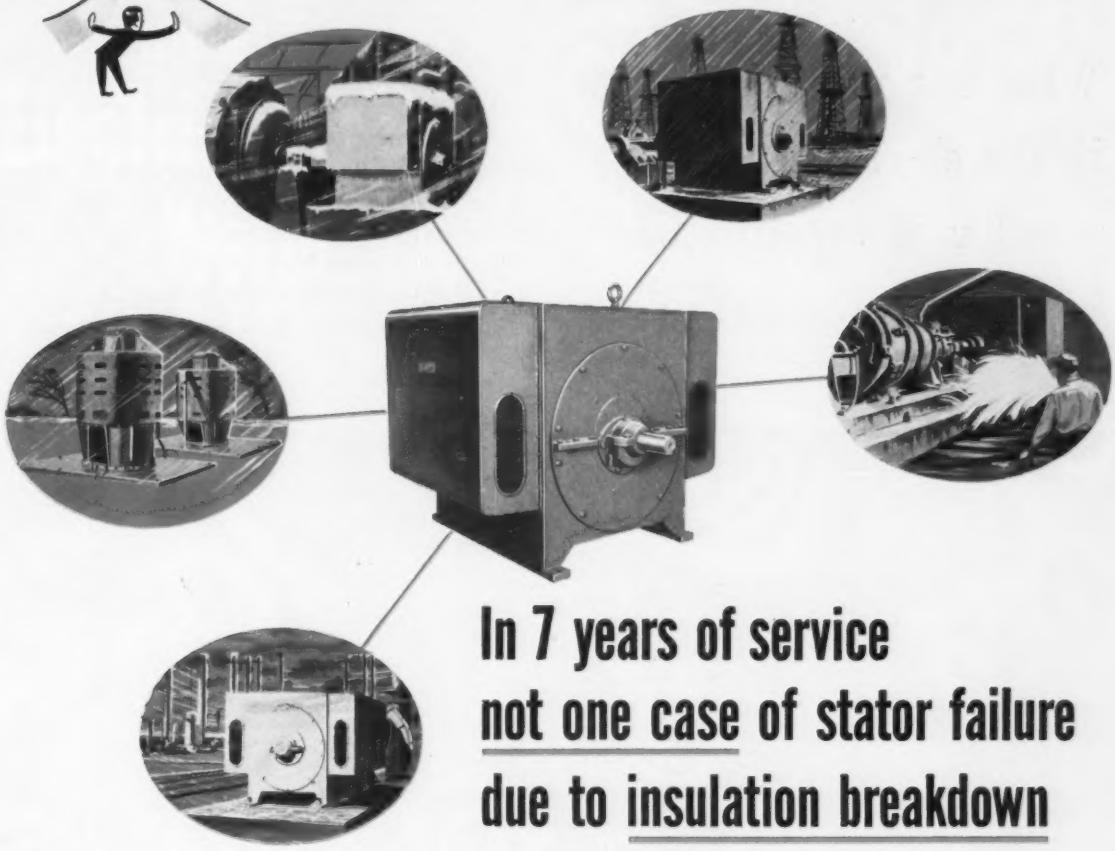
Opening and closing of steam valves is indicated by change of slope at various points on the curves. These points represent "dead spots" throughout the range of control and are not directly affected by adjustment of the governor motor rheostats. As dead spots interfere with proper automatic control, they should be minimized or eliminated by adjustment of the valve cams. The charts help in this.







LOOK BEHIND THE "INSULATION CURTAIN" BEFORE YOU SELECT A LARGE MOTOR



In 7 years of service not one case of stator failure due to insulation breakdown

● Merchandising alone doesn't "make" a motor. Fancy names, laboratory tests and "miracle formulas" don't mean a thing until actual, on-the-job service records back them up. Elliott insulation in large, squirrel-cage induction motors has proved itself. Since 1948, when Elliott weather-protected motors first went on the job, *not one* motor has failed because of insulation troubles. This is the record chalked up by more than 1,400,000 hp of motors in service – 500,000 hp of them in rigorous outdoor service operating in extremes of dampness, rain, snow, sleet, hurricanes, tornadoes, oil fumes, salt spray, and many other unusual conditions. What better proof of motor insulation dependability can you ask for?

This "outdoor" insulation system has been so successful that it has been extended to the entire Elliott large induction motor line wherever possible. For details see your Elliott field engineer or write Elliott Company, Ridgway Division, Ridgway, Pa.

MODERN ELLIOTT COIL INSULATION... and winding treatment combines the latest in materials with the know-how and thoroughness of application to make them successful. Some highlights:

- Ground insulation combining the ageless and high temperature resisting characteristics of mica with the tough, flexible support of Mylar* backing.
- A permanently elastic insulating varnish.
- Vacuum-pressure impregnation for sure, complete penetration. (Completely wound stator is finally sealed by immersion in a specially suited insulating varnish.) Bulletin PB 1400-4 tells the whole story. Write for a copy.

*Dupont Trademark

R6-8

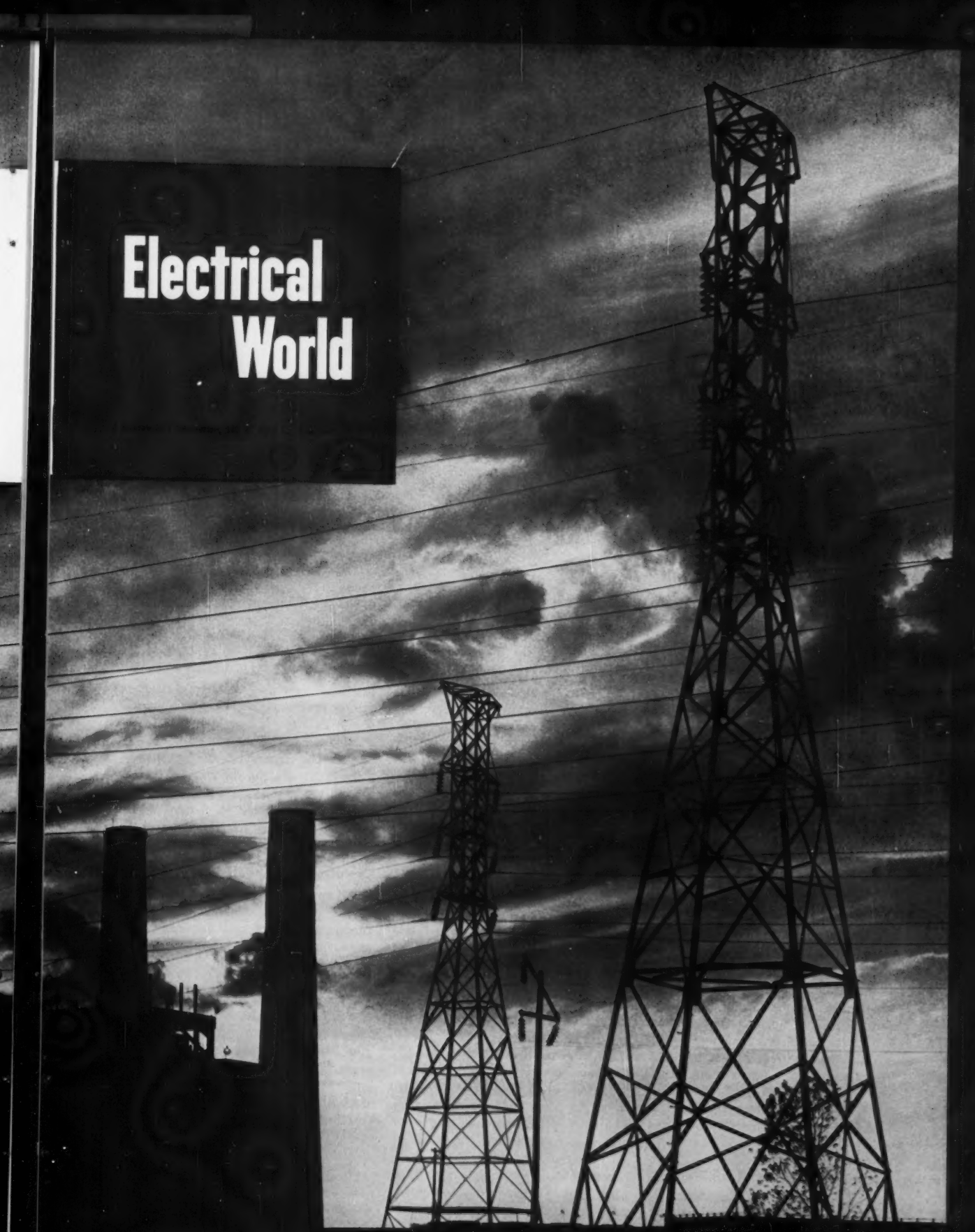
ELLIOTT Company

Elliott large motor insulation is "field-proven"

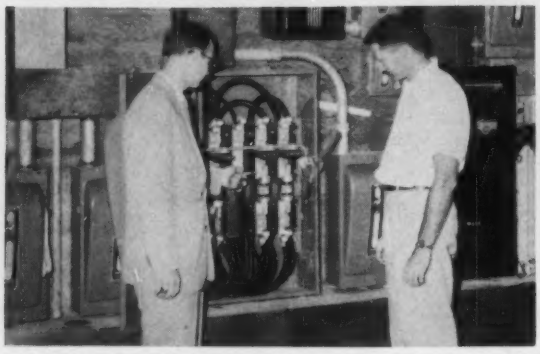
What one magazine in the electrical world matches the quality of your own product?

In your business, and in ours, preference can make or break a product. That's why we put such great store in the reader preference studies which many leading companies continually make among their own top customers and prospects. It's all so cleanly simple. Just two quick questions: "What electric power field publications do you read? Which one do you prefer?" Happily for all concerned, Electrical World wins these consistently by a vote of 4-to-1 *or better*. When your best customers suggest the best magazine to carry your advertising, it's pretty hard to go wrong, isn't it?

This photo by Robert Yarnall Richie of outgoing power lines was taken at dusk at the plant of



Houston Lighting & Power Co., Houston, Texas. On this subject of transmission alone, Electrical World ran nearly 100 pages of editorial during 1933.



NEW SERVICE ENTRANCE provides 1,400-amp capacity for present loads and space for new circuits to handle growth

NEW DISTRIBUTION PANEL has 24 power circuits and 42 lighting circuits. Another distribution panel was enlarged

Dairy Gets New Wiring But No Shutdown

R. J. O'CONNOR, Sales Promotion Specialist, Idaho Power Co, Boise, Idaho

Two distribution centers, a 1,400-amp service entrance to replace a single 400-amp switch, new lighting, and re-servicing of buildings around the plant were proposed to a dairy that was facing expansion. The expansion program was geared to daily operations to avoid interruptions of output.

Triangle Dairy Co's original plant at Boise, Idaho, was served by a single 400-amp, 4-wire solid-neutral switch. Continual trouble stemmed from this wiring bottleneck, as well as from other plant wiring. So many additions had been made to additions that practically only one electrical contractor was capable of finding trouble in the maze of junction boxes, taps, and splices.

Recommendations Accepted

These conditions prompted the dairy to accept the utility representative's recommendation of including ample distribution capacity in its plans for expansion. Such capacity would assure increased production at lower maintenance and repair costs. It would free the dairy's management from worry over shutdowns.

The new electrical system now has a service entrance capability of about five times the old service. Main switches are two 400-amp and three 200-amp units. Two distribution centers, one new and the other enlarged, provide 84 power and lighting circuits for present and future load. Total present connected load includes 200 hp of motors and 40 kw of heating and lighting in the enlarged plant, a shop, a milking barn, and an office.

Distribution Elements

Basic in the new electrical system is the main 120/240-v, 3-phase, 4-wire panel, served by two sets of three 500-MCM RH cable and a bare 3/0 neutral in rigid conduit. Metal gutters above, below and part way down the panel carry the wiring to five main switches. From there it goes to individual load switches, and 14 outgoing circuits that feed the dairy plant and adjacent buildings. Distribution panel B is served from the main panel by three 300-MCM and one 1/0 cables in conduit, while panel C is served by three 3/0 and one No. 2 cables in conduit. Additional space is left on the main and B panels for future switch positions. Panel B provides 24 power circuits and a lighting panel for 42 circuits. Panel C was enlarged to provide for 18 present and future circuits. Both panels have metal gutters for wiring.

As the plant's entire day-to-day operation could not be interrupted, expansion of the wiring system had to be geared to the production setup. The architect provided the expansion plans, the equipment supplier set up his delivery schedule, and the utility power salesman completed the electrical plan. In addition, the power salesman coordinated construction and operation so that rewiring could be done without electrical interruption.

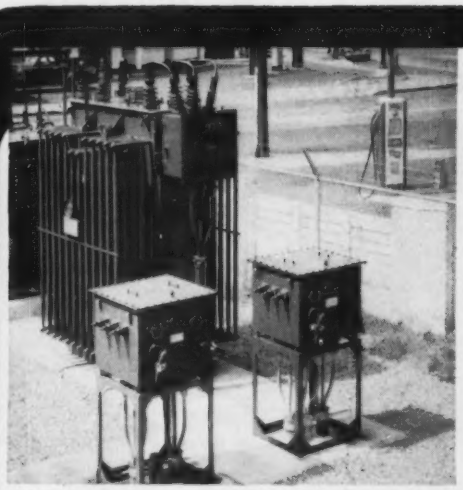
The main panel was installed first, followed by installation of distribution panel B and enlargement of panel C. Then circuits were run from the main to the distribution panels.

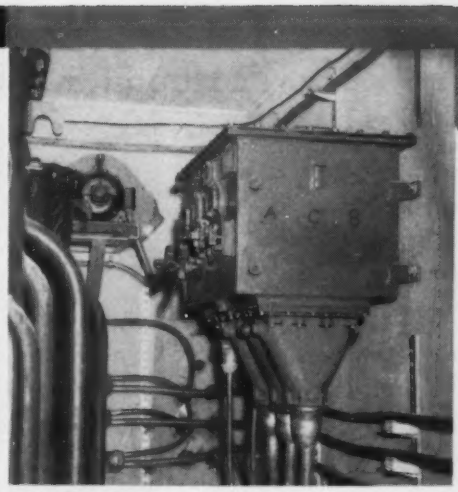
Through a temporary circuit to the existing main panel, power was fed to the new main panel. After the new service drop was run to the new main panel, the temporary circuit and the old main panel were cut out and removed. The electrical contractor spent three nights making the cutover from the old to the new main panel. However, the cutover was so planned that the plant continued to operate without noticeable interruption.

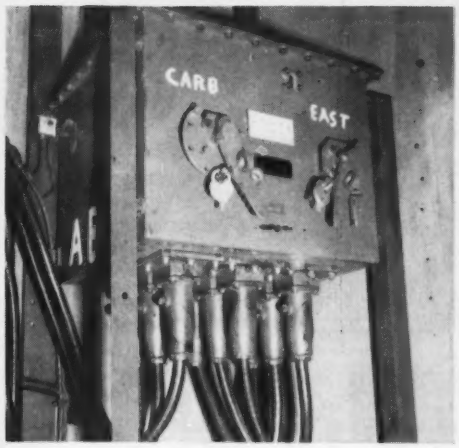
Circuits Are Labeled

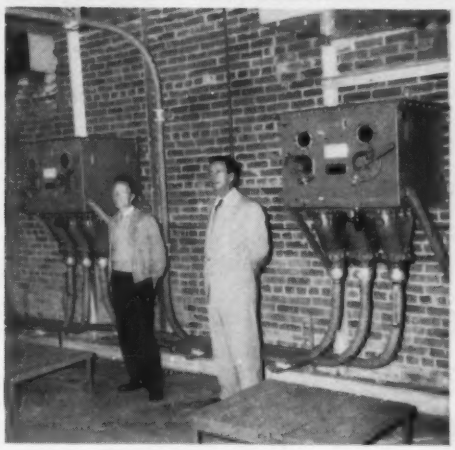
All switches and panels in the new system are clearly stenciled as to their function. Circuits and conduit runs are identified to aid the maintenance crew in the locating of circuits and switches.

The electrical plan includes slimline fluorescent fixtures with porcelain enamel reflectors to provide about 60 ft-c in the working areas. Storage areas have incandescent lighting which supplies about 30 ft-c. New exterior dock and protective lighting also was installed. Triangle Dairy believes its losses from theft will be almost nullified now by the new lighting system, because a previous but smaller protective lighting system cut losses of equipment and gasoline noticeably.









LOAD BREAK OIL SWITCHES

make cable systems f-l-e-x-i-b-l-e

G&W TYPE "RA" OIL SWITCHES provide safe, convenient and low cost means for sectionalizing distribution circuits. They have been used since 1928 by many electric utilities. They have a remarkable trouble-free operating record which fully justifies their use as load break disconnects for single and multiple circuits. They are simple in construction, installation and maintenance. They operate properly after long periods of inactivity to provide for isolation of cable sections in case of faults. They permit rapid re-routing of circuits to materially reduce losses incurred through electric service interruptions. They are made in many styles for 2 way to 6 way, cable or overhead connections, 400 ampere, voltages up to 34.5 Kv.

It will pay you to investigate the possibilities of Type "RA" oil switches for your distribution system. Send for Bulletin DB51 and call in our engineer representative.

G&W ELECTRIC SPECIALTY CO.
7780 Dante Avenue, Chicago 19, Illinois

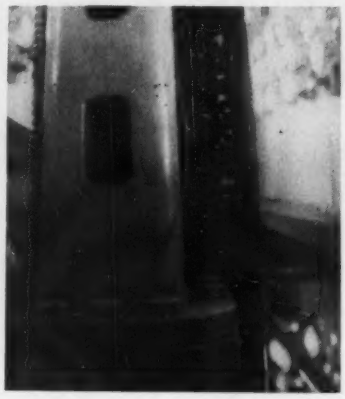
Canadian Mfrs.—Powerlite Devices, Ltd.
Toronto, Montreal and Vancouver

Representatives in principal cities of U.S.A.

D562

Infrared Restores Flood-Ravaged Motor

L. M. DURYEE, Industrial Sales Engineer, Connecticut Light & Power Co, Waterbury, Conn.



Infrared heat enclosed in a homemade plywood oven is credited with restoring a 750-hp synchronous motor to service after the flood of August 1955 which swept through Connecticut.

The motor, which drives five rolling mills on a 40-ft shaft, was inundated by 14 ft of water in the Waterbury Rolling Mills plant. In starting rehabilitation, Plant Engineer Herman Schaeffer decided that a motor of this size could not be moved for repairs.

Therefore he surrounded the motor with a plywood structure, wired 50-kw of radiant heat lamps inside of this "oven," directed the heat rays into the motor field winding, and hoped for the best.

After 48 hours, the motor tested dry and was ready for service again. The enclosure was removed, the motor was started, and the windings were found serviceable. The lamp drying technique met this emergency situation and the motor has operated properly ever since. This was the first prolonged shutdown for this motor in 25 years.

INDUSTRIAL NEWS NOTES

A Cool Tool

More and more industrialists are using air conditioning as a production tool. Temperature and humidity control reduces spoilage, corrosion, and production delays. Modern high-speed machines make exacting demands upon the atmospheres in which they work. Air conditioning helps keep both machines and men working at top efficiency, reports F. G. Coggin, Detroit Controls Co.

•

Dc Crane Works on Ac

A 400-v gantry crane, equipped with 100 and 40-hp dc motors for loading steel on railroad cars, is working well on ac power, reports The Electric Controller Mfg Co, Cleveland. Frequency relay controls and a special hoist controller are credited with endowing the crane with stable hoisting and lowering speeds.

•

Seeing the Invisible

Closed circuit TV is keeping an unblinking eye fixed on a device that spots off-center loading on a 35,000-ton forge press used by the U. S. Air Force. This critical indicator is not visible to the operator, but a TV camera watches it. The operator monitors a screen near his control station and makes immediate corrections, to prevent damage to the press, if eccentric pieces load the platens improperly.

•

Tightens Own Belt

A motor can automatically tighten its own belt if mounted on a new base that gives-and-takes as required. New belts are slipped on in minutes without motor or belt realignment, reports Murray Equipment Co of Detroit.

•

Good Year, Past & Present

Sales of industrial electric power during 1955 surpassed the 1954 level by 11.4% for Pennsylvania Power & Light Co, and came within 1.3% of hitting the record high of 1953, the company reports. Pennsylvania's business outlook for 1956 is good—even the anthracite slump shows promise of tapering off.

Drying freshly painted cars is now done with a rack of infrared units to speed up jobs at Brooklyn Motors, Inc, Baltimore, Md. Air drying of newly painted cars was becoming a serious menace to the business due to floor space occupied which, in turn, delayed work on other jobs. But a 12-kw bank of infrared units mounted in polished reflectors solved this problem. The vertical rack consists of 4 rows of 4 units each, plus 2 rows that can be positioned, for instance, over a car's hood. Lacquer and enamel finishes now emerge with the quality of the original factory paint job. W. W. Clouse, Industrial Representative, Baltimore Gas & Electric Co, Baltimore, Md.

Thawing coal with infrared heat has expedited substantially the unloading of railroad cars at Lakefront Docks, Toledo, Ohio. An experimental infrared setup worked well, it was found. Thawing time was cut in half over previous methods. The initial test was so successful that Lakefront Docks has installed 12 units, six on each side of the track, for further testing. If these 12 units work as predicted, the company will install 24 more units so that three cars can be thawed simultaneously under an overhead shelter. It is felt that this method of thawing could be applied to any bulk commodity, including limestone and iron ore, and for drying washed coal. The method also might provide an answer to thawing ore that freezes in dock pockets and loading spouts. This would help to lengthen the shipping season. To date, thawing coal cars, and cars containing iron ore, always has been a problem. Steam, torches, and gas and oil burners all have been tried at considerable expense.

SEND IN *YOUR* INDUSTRIAL BRIEF

You'll get a great deal of satisfaction from knowing that your item may help someone else with a similar problem. And you'll get a $5 honoraium too for each item accepted. Send us the basic facts covering the application; the name and location of user; benefits, advantages, and load characteristics of the application. Mail to: Industrial Editor, Electrical World 330 W. 42nd St., New York 36, N. Y.

NEW

CHANCE Type F CUTOUT
meets all your present and future requirements

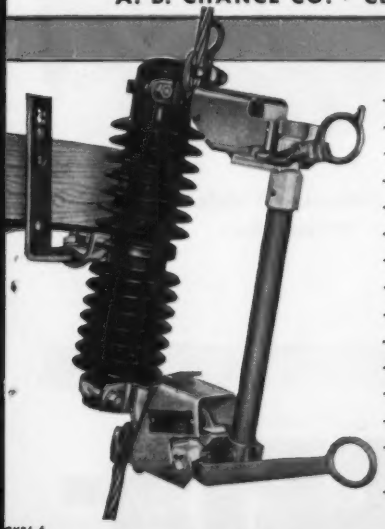
11 possible combinations with 1 fuse mounting 5.2, 7.8, 15 kv Ratings

One fuse mounting—interchangeable fuseholders give you 100 or 200 amp regular or 100 amp load break cutouts—interrupting capacities 2000 to 12000 amps, plus a disconnect

Here's a way to simplify your cutout stocking problems—lower storage, handling and installation costs. With the Chance Type "F" line of cutouts, you stock only one type of fuse mounting and a choice of fuseholders for complete system protection. You can choose from *eleven* different combinations, including a disconnect, to fit your exact needs. And when you want to up-rate an installed cutout or convert it to load break, a simple change of fuseholders does the job—*in the same fuse mounting!*

The Type "F" Cutout combines 16 important features asked for by distribution engineers in a nationwide field check . . . and *only* the Chance Type "F" offers *all* these features! Check the table below. Ask your Chance Distributor to show you this new Cutout line, or write us.

A. B. CHANCE CO. • CENTRALIA, MISSOURI • San Francisco, California • Pittsburgh, Pennsylvania

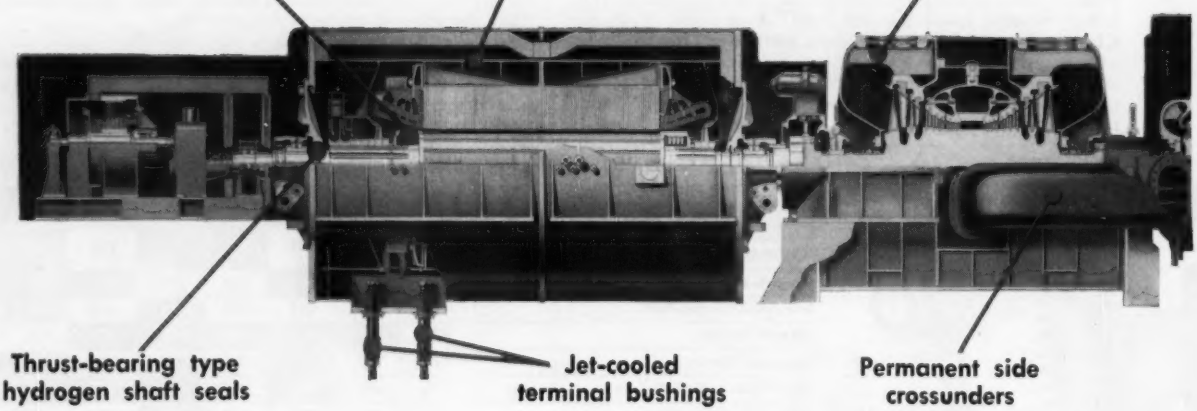


CK56-6

	Chance Type "F"	Cutout "G"	Cutout "H"	Cutout "I"	Cutout "J"	Cutout "K"	Cutout "L"	Cutout "M"
Interchangeable Fuseholders Covering Complete NEMA Range	YES	NO	YES	NO	NO	YES	NO	NO
Wrap Around Insulator Bolts	YES	YES	NO	YES	YES	NO	NO	NO
Bird Proof Construction	YES	YES	YES	YES	NO	YES	NO	YES
Lift and Tie Ring	YES	NO	NO	NO	NO	NO	YES	YES
Universal Terminals	YES	YES	NO	YES	YES	YES	NO	NO
Sleet Hoods at Both Ends	YES	YES	NO	YES	NO	NO	NO	NO
Positive Guiding of Tube	YES	YES	YES	YES	NO	YES	YES	YES
Positive Latch	YES	NO	NO	NO	NO	NO	YES	NO
All Contact Surfaces Silver Plated	YES	YES	YES	YES	NO	NO	YES	YES
Self Cleaning Contacts	YES	YES	YES	YES	YES	NO	YES	YES
Lever Action When Opening	YES	NO	NO	NO	NO	NO	NO	NO
Link Ejector	YES	NO	NO	NO	NO	NO	YES	YES
Load Break	YES	YES	YES	YES	YES	YES	YES	NO
Fuseholder Cannot be Installed Backwards	YES	YES	NO	YES	YES	YES	YES	YES
180° Stop to Prevent Fuseholder Swinging Back into Pole	YES	NO	NO	YES	YES	NO	NO	YES
NEMA Standard Mounting Bracket	YES	YES	YES	YES	YES	YES	YES	YES

CAPACITY of this station has been raised to 270,000 kw by the installation of an Allis-Chalmers 100,000-kw turbine-generator. The new unit makes the station one of the largest in the area.

Here's MORE Power


Supercharged cooling of rotor
Symmetrical stator with flexible core support
Fabricated steel low pressure casing
Thrust-bearing type hydrogen shaft seals
Jet-cooled terminal bushings
Permanent side crossunders

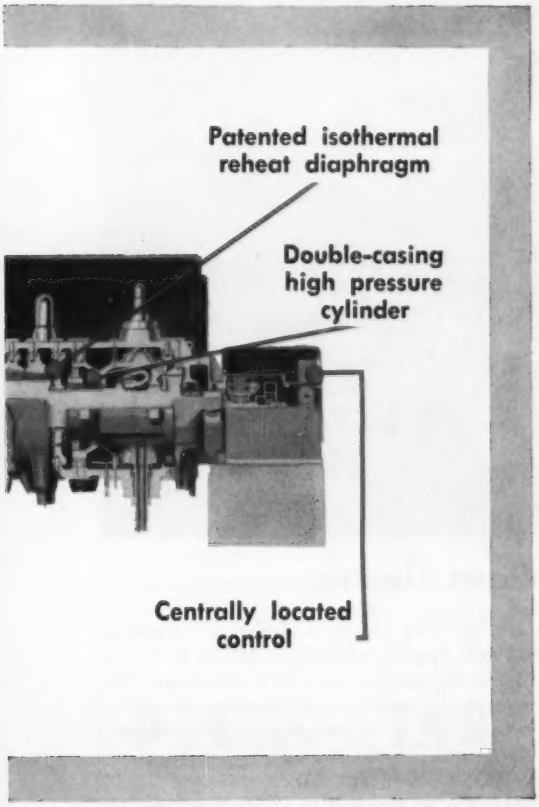
A-C ALLIS-CHALMERS

ALLIS-

STEAM CONDITIONS for this 100,000-kw turbine are 1450 psig, 1000 F inlet, 1000 F reheat, 1.5 inch mercury absolute exhaust. Generator rating is 133,689 kva, 0.85 pf, 13,800 volts, 0.64 short-circuit ratio, at 30 psig hydrogen pressure.

Pioneer Service & Engineering Co., consulting engineers

Pioneering



New 100,000-kw reheat unit in midwestern utility combines side-crossunder, tandem-compound steam turbine with supercharged hydrogen-cooled, 3600-rpm generator.

To meet present and future requirements, this modern Allis-Chalmers turbine-generator combination went into operation recently in a large midwestern utility power plant.

Typical of Allis-Chalmers tandem 3600-rpm reheat turbines for ratings of 75,000 to 250,000 kw, this 100,000-kw unit joins others already proved in operation.

You can continue to look to Allis-Chalmers for MORE pioneering of turbine-generator units engineered to your requirements — up to 500,000 kw. For more information, contact your nearby A-C representative, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

A-4985

CHALMERS

Let Salesmen Set Own Goals

Union Electric's "Name Your Quota" contest boosts water heater sales. Salesmen double their bonus—if quota is made

ROBERT L. COE, Residential Sales Manager, Union Electric Co of Missouri, St. Louis

When the sales manager establishes sales quotas he's apt to hear, "That's too blamed high." But when Union Electric Co, in its "Name Your Quota" contest, asks salesmen to set their own water heater goals, they invariably choose the "he man" variety. And they set their sights higher to achieve them.

Competes with Self

The annual two-month contest, started in 1952, doesn't put the salesman in competition with others. He competes with himself to reach a self-imposed goal. And the tougher the goal, the higher the rewards.

In the company's 1955 contest, retail salesmen set personal quotas totaling 1,037 water heaters compared to 954 in 1954. A total of 515 contest sales were approved, an increase of 20% over the previous year. Actual sales, though, reached 890 during the two months. Men with only one or two sales evidently didn't bother to report.

Gets Extra Awards

Here's how it works: Retail appliance salesmen earn extra awards as shown in the table for electric water heaters sold and installed in Union Electric's residential customers' homes during the contest.

But, each man may select a quota of from one to five sales. If he makes his quota he gets a bonus of twice as much.

Thus, when John Doe selects and makes a ceiling of five sales, he earns a total of $30, instead of the regular $15. But Joe Doakes, who set his own goal at two water heaters then sold five, only receives $18 (double award on the first two sales and the regular awards for the others).

As a group, the salesmen haven't made their collective quota in any of the four years since the contest began. Individuals have made and greatly exceeded their own goals, but all together they set their sights high. We think this is good. It proves that, given the opportunity to make their own decisions, appliance salesmen chose difficult rather than easy targets.

Wholesale salesmen also are eligible to earn cash awards of $1 for each sale, in excess of ten, credited to their accounts.

Cash awards are presented after the contest at a Winners' Barbecue which is open to all retailers' men who sell at least one water heater during the contest. Retail champion in last year's contest made 40 sales. Nine wholesale salesmen and 135 retail salesmen earned cash awards.

We like the "Name Your Quota" type of promotion. Dealers like it. And the retail and wholesale salesmen look forward to the contest and barbecue each year.

Water Heater Cash Awards

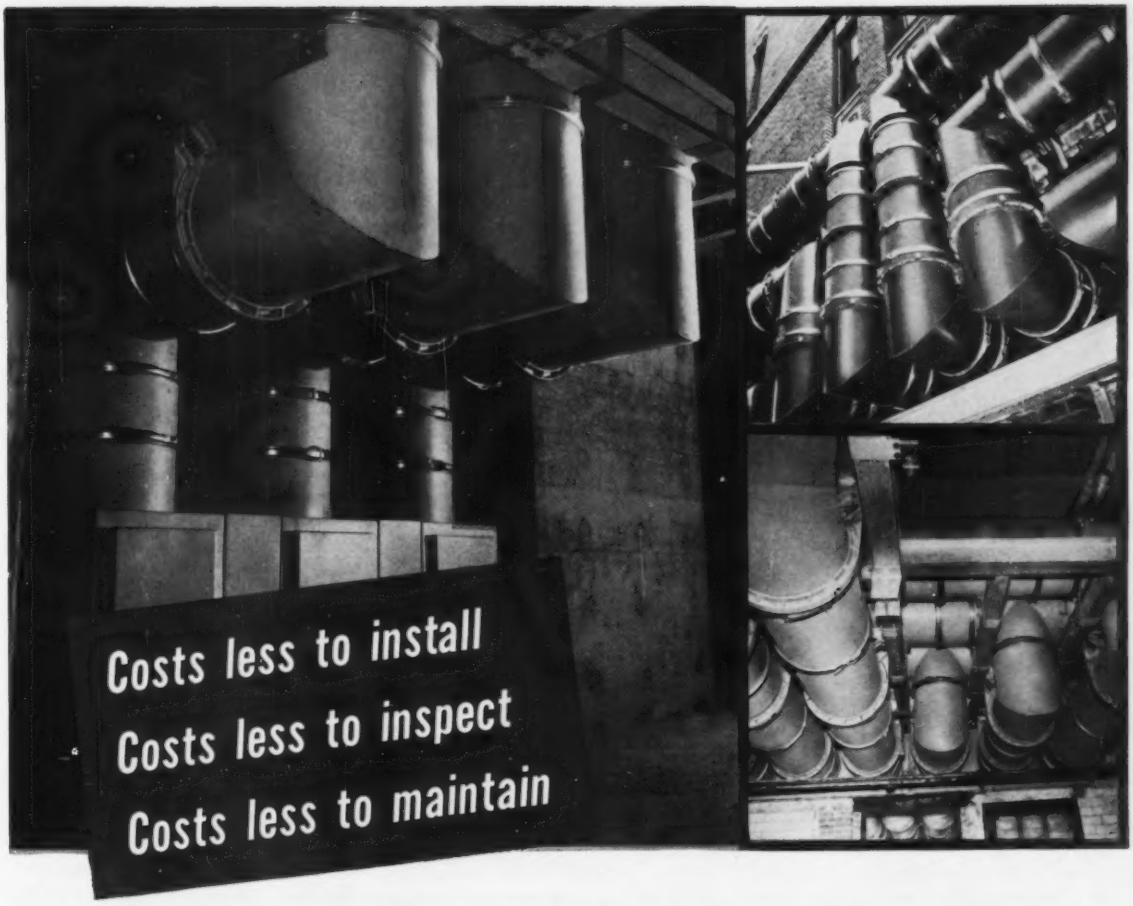
First sale	$ 1
Second sale	2
Third sale	3
Fourth sale	4
Fifth sale	5
Next four sales	5 each
Tenth and over	10 each

(*More S & S on page* 120)

Florida Chickee Goes Electric

Not many of Florida Power & Light Co's customers display advantages of electric living as openly as Mrs. Sam Franke, a Seminole Indian housewife living in this chickee on the Dania Reservation near Ft Lauderdale. Her second-hand range is drawing swarms of reservation women who, because of century-old superstitions, have been obliged to fry bread, grits, and wild birds over outdoor fires.

Mrs. Franke's break with tradition, followed by on-the-spot instruction by Dorothy Mims FP&L home service rep, is expected to start other Seminole women following suit. The family's chickee, with conventional southern exposure and fringe-on-the-top design, also includes an electric refrigerator and sewing machine.



New Delta-Star Telescoping-Cover Bus

Compared to any other isolated phase bus, installing Delta-Star's new telescoping-cover bus is quicker, easier and more economical. That's because covers are an integral part of the enclosure—not separate units to install. No bolts needed—no covers to lift—no longitudinal gaskets required.

Quick access reduces bus inspection and maintenance time. Simply slide back the telescoping section to open—slide forward to close. Easily operated clamping rings lock and seal enclosure against moisture and dust.

At the State Line Station of the Commonwealth Edison system, the installation of a Delta-Star three-phase bus run demonstrates these cost-reducing advantages. This bus is used with a 207,000 kw cross compound turbine generator. It has a rating of 15.5 kv at 6,000 amperes for the generator of the high pressure turbine, and 5,000 amperes for the generator of the low pressure unit. Also, the bus from a transformer tertiary is rated 23 kv, 3,000 amperes.

For your next installation—be sure to check Delta-Star's telescoping-cover bus. Your Delta-Star representative is nearby.

DELTA-STAR ELECTRIC DIVISION

HKP

H. K. PORTER COMPANY, INC.

2437 Fulton Street • Chicago 12, Illinois

District Offices in Principal Cities

Continental Radiant Glass Heating Corp. photo

UMW Uses Electric Heat; Lewis Glows

John L. Lewis, fiery head of the United Mine Workers union, is backing up glowing words on electric heating by deeds. The union leader, who last year told newsmen, "The world knows that the best heating for homes and buildings is electricity," has seen that ten UMW Memorial Hospital housing units like the Wise, Va., building above are being warmed by steam generated electric power.

"The only possible source for electric power to heat tomorrow's homes economically . . . is coal," he told Washington, D. C., correspondents. "On every hand the indications are that more and more coal will be needed as people switch away from oil and gas."

Lewis, optimistic about the coal industry's future, said that the industry will reach new heights in the next two decades. Based on increased coal usage by the electric industry, his outlook is justified. In 20 years ending in 1954, steam generating plant consumption jumped from 27,707,000 tons to 115,235,000 tons.

S & S SHORTS

Seattle Adds Dryer Bonus

City Light of Seattle, Wash., now gives customers up to $65 for their purchases of ranges ($30), water heaters ($25) and dryers ($10). Recently added dryer premium applies to new and old homes. Money for ranges replacing flame-types and water heaters of 50-gal size or larger is for existing home modernization. Seattle's system now has 174,079 electric ranges out of total 250,497 meters.

'100-Plus' Campaign Hits Chicago

Builders of new homes with 100-amp service started getting Commonwealth Edison Co's tie-in help this month. Home labels, signs, handout material will help sell adequately wired houses in company's "100-plus" ad campaign. A "share the cost" plan that pays for service entrance wiring for additional 240-v appliance is still offered to owners of existing homes.

30,000,000 Lighting Prospects

Utilities, merchandisers can reap big profits by selling outdoor lighting to cultivators of 30,000,000 U. S. gardens, according to Westinghouse Electric Corp's Lamp Division. Two booklets, available at publisher's costs, two types of slides are offered by firm's Residential Lighting Dept, Bloomfield, N. J. Also available is listing of garden lighting equipment manufacturers and their catalogue sheets.

(*Continued on page* 160)

LBE Sales Hints

Judy Garland's TV show on April 8 gave U. S. consumers the first formal nationwide introduction to Live Better . . . Electrically. It was the take-off point for some varied promotions including these highlights:

• More than 200 participating utilities began scheduling local showings of "Meet Mrs Swenson," a 28-min color movie depicting a happy ending to a homemaker's wiring woes.

• Four-color advertising spreads started catching the eyes of between 35-40-million readers of ten national magazines. The copy advises consumers to contact their local electric company for know-how on electrical living up-grading.

• A 72-page booklet, "New Step-By-Step Ideas to Help You Live Better . . . Electrically," also plugged in the magazine ads, gives LBE prospects illustrated "how to" details.

KG&E's "Bandwagon" Reaction

"We want on the bandwagon" is response of contractors, appliance dealers and distributors in Kansas Gas & Electric Co areas to its Live Better . . . Electrically promotion. In a carefully planned follow-up of the Feb. 8 closed circuit telecast, KG&E blankets these fronts:

• Kinescope showings of the telecast in outlying towns give entertainment, emphasize LBE profit values, and gain good reactions.

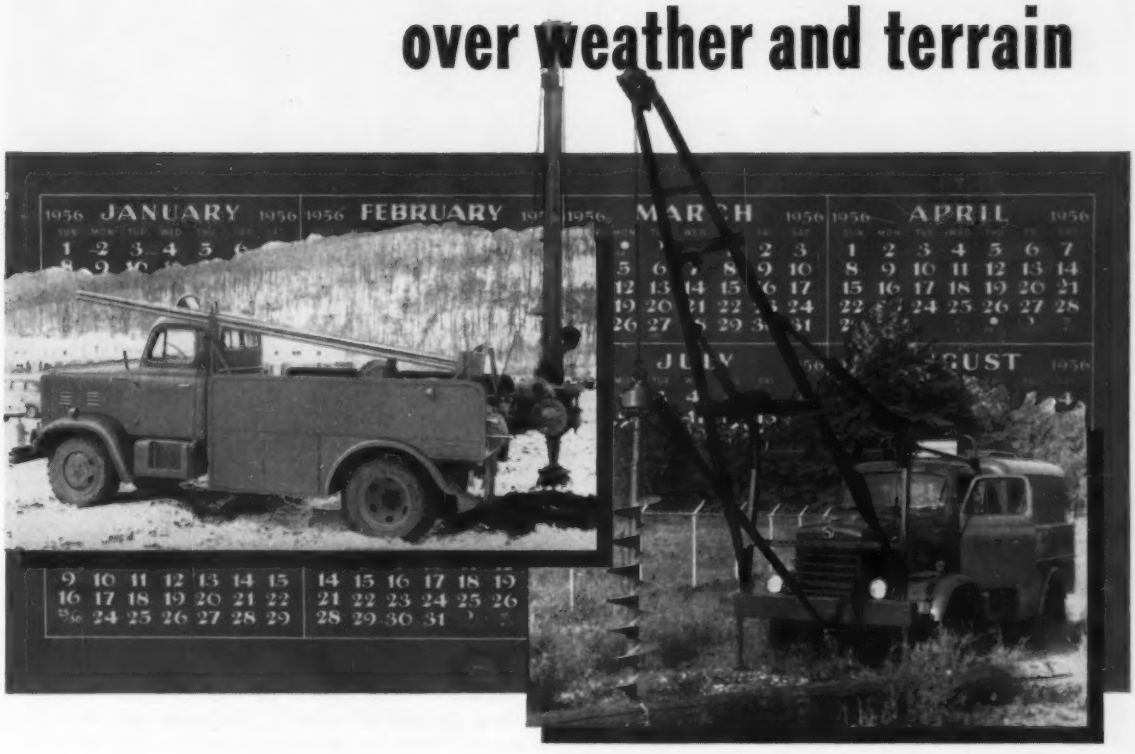
• The LBE banner is flying on **1.** A parade float, **2.** A Farm and Home Exhibit, **3.** Permanent office window valances, and **4.** Stage and floor displays. It's also prominent in newspaper, TV and radio ads.

• Financial institutions, builders, realtors, and architects are getting a convincing sales pitch on financing, values of electrical modernization.

every day – or in emergencies...

YOUR ONLY CONTROL

over weather and terrain



There are no normal work conditions in line work. Sunshine or sleet, sand, mud or snow, hill or hollow . . . they're all in the day's work. The only control you have over weather or terrain is a Four Wheel Drive truck!

FWDs ask no questions. They just get there and do the job. The new FWDs are fast and flexible for scattered line maintenance jobs. They're rugged and dependable for tough line construction assignments.

You can choose the type of body that fits your requirements and the power and weight proportioning that's best for your terrain. There are front or rear-mounted derricks and diggers with power take-off designed for utility tools.

This is the truck that's as dependable as your service has to be. Efficient for the day-to-day jobs but with a priceless power reserve for emergencies. Find out how the versatile new FWDs fit your service requirements!

FWD MATH-MATIC DESIGN

THE FOUR WHEEL DRIVE AUTO COMPANY • CLINTONVILLE, WISCONSIN • *Canadian Factory* • KITCHENER, ONTARIO

230-Kv Station Posts

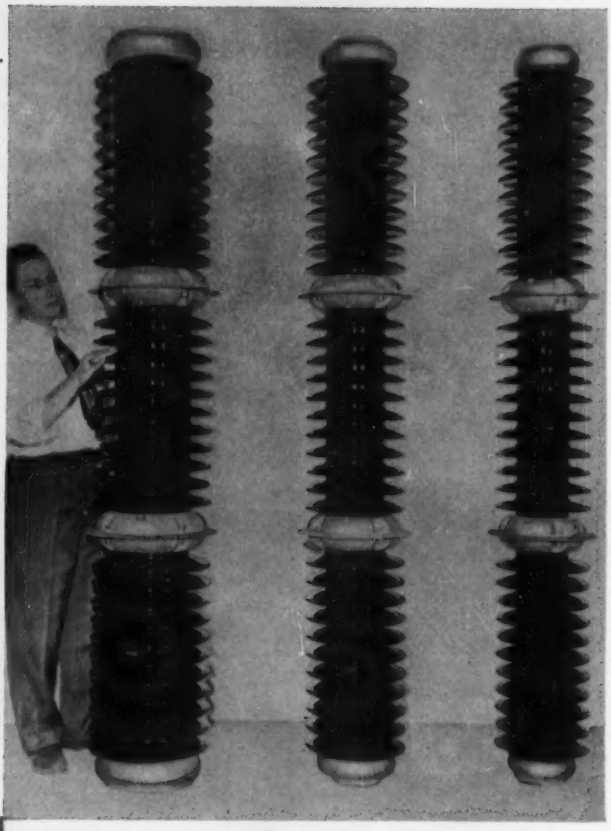
Six station posts for h-v (196/287 kv) switch and bus use are rated 230 kv. Each consists of 3 sections of porcelain with caps or flanges cemented to the ends. The sections are bolted with 4 hex head bolts—8 bolts per stack.

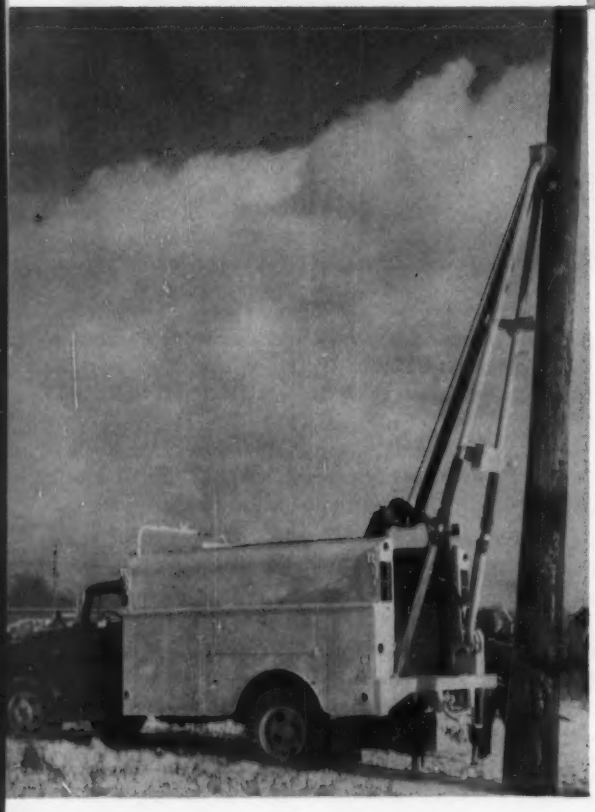
The new stacks have 6 cemented joints. Manufacturer says this increases stiffness of the assembly and improves margins of safety over ratings, both electrically and mechanically.

Two electrostatic rain deflectors, assembled into the bolted joints of each unit, give increased wet flashover values. Porcelain is Lapp Vacuum Process, chocolate brown glaze.

Illustrated are 3 92-in. insulators with BIL level of 1,050 kv and cantilever strengths of 750, 1,170 and 2,300 lb. The other 3 units are 80 in., have 900-kv BIL withstand rating, and 910, 1,450 and 2,750-lb cantilever strengths.

Lapp Insulator Co, Inc, LeRoy, N. Y.





Power Derricks

A series of live-boom power derricks has maximum load capacity of 6,000 lb. The series has two models—5700 LM for lifting poles up to 45 ft long and the 5700 HM for 55-ft poles.

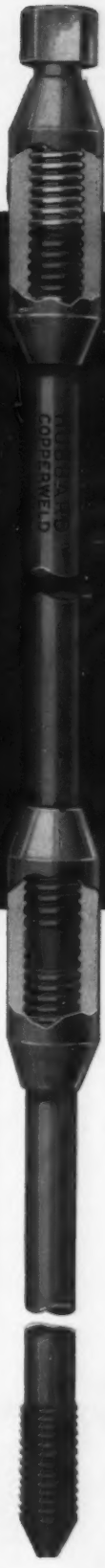
The derrick is raised and lowered by a double-acting cylinder. By moving a hydraulic control lever, the operator moves the derrick from its overhead storage position to within 5½ ft of the ground where the winch is threaded.

The derricks are available with two types of lockings for the side legs—pin-type and hydraulic-sleeve-lock-type. A relief valve in the hydraulic system provides built-in safety, while fixed flow restriction prevents rapid fall.

J. H. Holan Corp, 4100 W. 150 St, Cleveland 11, Ohio.

(*More New Equipment on page* 126)

DRIVE DEEP!



Seasonal variance in water table levels for a given locality is a factor of prime importance in efficient grounding. This fluctuation has a definite relationship to permanent moisture levels which must be reached and maintained for grounding rods to be effective. Deep grounding procedure coupled with regular testing provides a sound basis for maintaining maximum protection for equipment and personnel, as well as continuity of service.

That's because deep grounding assures you of a good connection with permanently moist, low resistance soil. Lets you work to a standard of low resistance that gives maximum dependability to the performance of your protective equipment.

Hubbard Copperweld sectional ground rods are made especially for deep grounding. They are designed so that additional sections may be added as needed to reach the depth of permanent moisture and the proper standards of resistance. And they're Molten-Welded, an exclusive process that makes Copper and Steel perform as a single solid unit, yet gives the high conductivity and corrosion resistance of Copper and the strength of Steel.

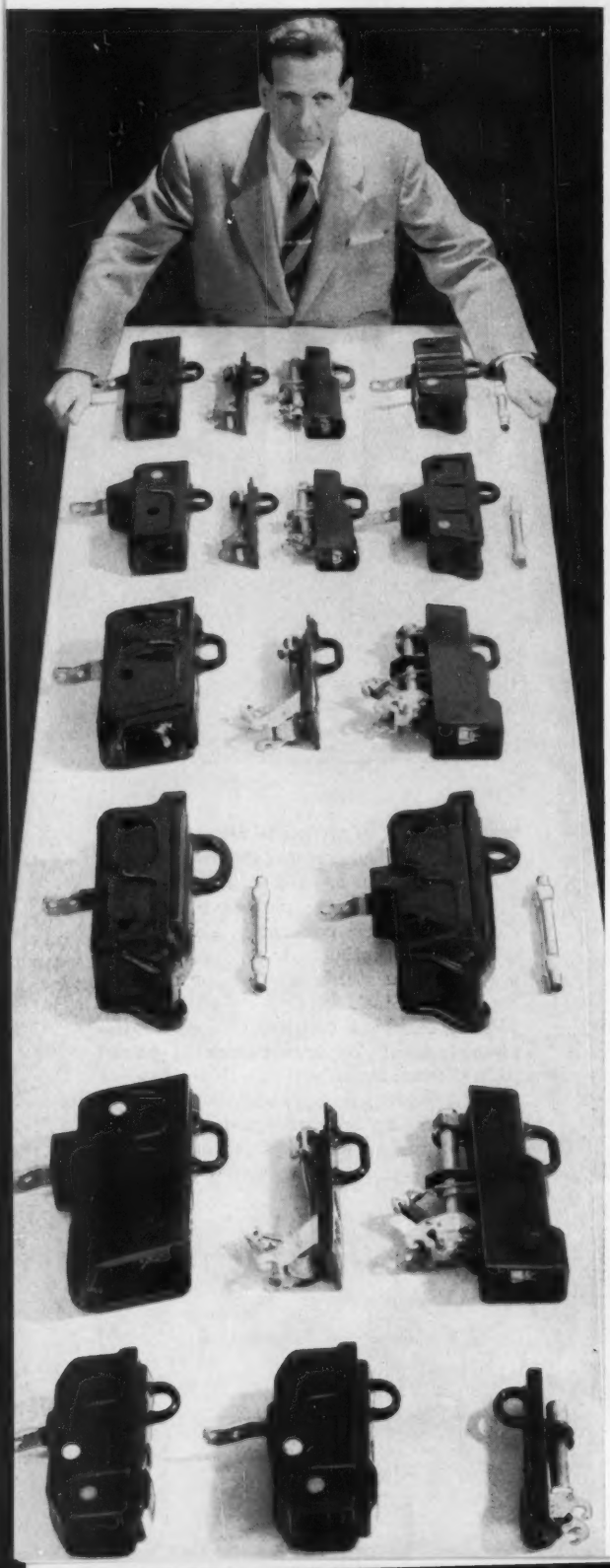
Your Hubbard distributor carries complete stocks of Copperweld sectional ground rods. Contact him. Meanwhile, if you haven't already received a copy, write for Practical Grounding, an informative handbook of grounding principles and practices, and complete details on how it works.

HUBBARD AND COMPANY

6301 Butler Street
Pittsburgh 1, Pa.

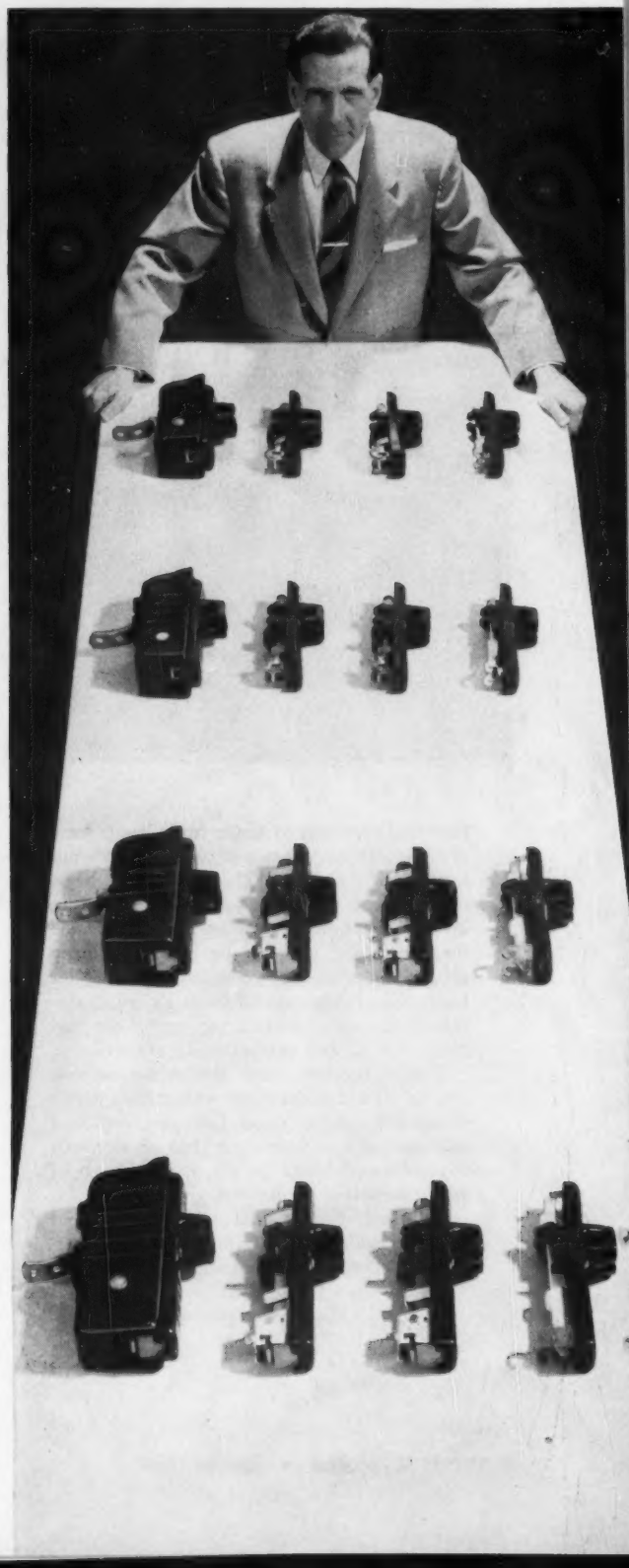
old

Stan Howard, Supervisor, Product Engineering, displays 10 housings and 15 doors of old cutout design.



new

In new design, Stan shows total reduction in housings and doors while interrupting ratings are increased.



ALL-NEW ENCLOSED FUSE CUTOUTS

now...

Stocking is simplified, interrupting ratings increased in new G-E fuse cutout line

Not since 1935, when General Electric first introduced the "family" concept of interchangeable doors, has there been an enclosed fuse cutout development like this!

ALL THE FUNCTIONS—with fewer housings. Before, it took ten housings and fifteen doors to do the job. Now, in G.E.'s all-new line, *four housings and sixteen doors meet every standard cutout need!*

Think of what this means to you and your lineman: There's less chance of error. Stocking is simplified, too. Smaller inventories mean lower handling and storage costs—and lower installation costs. All the lineman has to do is change doors to uprate the cutout.

EVERYTHING YOUR SYSTEM NEEDS. G.E.'s new fuse cutout line gives you all functions—drop-out, non-dropout, indicating, disconnect—in one basic design. You get normal-duty, heavy-duty and/or extra-heavy-duty in all ratings, to match every possible system demand. For a complete description of the new cutout line, write for Bulletin GEA-6208, General Electric Company, Section 433-9, Schenectady 5, N. Y.

LINEMEN AND ENGINEERS AGREE

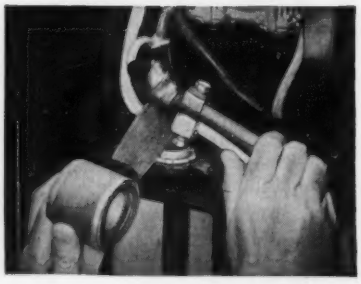
The completely new line of G-E fuse cutouts has more of the features they prefer. There's good reason, too—the new design incorporates suggestions made by utility engineers and linemen to G-E sales engineers and specialists.

Progress Is Our Most Important Product

GENERAL ELECTRIC

Volseal...

the new high dielectric putty...

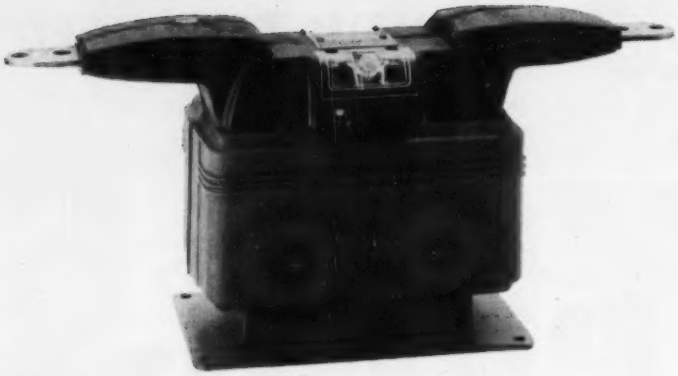


makes sealing easier!

NEW Johns-Manville Volseal is a high dielectric putty designed for sealing heavy cables and irregularly shaped objects. It has a dielectric of 445 vpm, together with excellent physical properties. Resists acids and alkalis, weathers well, is highly resistant to water, does not corrode metals.

Volseal also offers easy application. It is highly elastic, provides good adhesion, hardens within 3 hours on air curing. Available in extruded beads, ribbons and pugs. For complete details on Volseal and its new companion product Napseal, the petroleum resistant sealing compound, write Johns-Manville, Box 60, New York 16, N. Y. In Canada, 199 Bay Street, Toronto 1, Ontario.

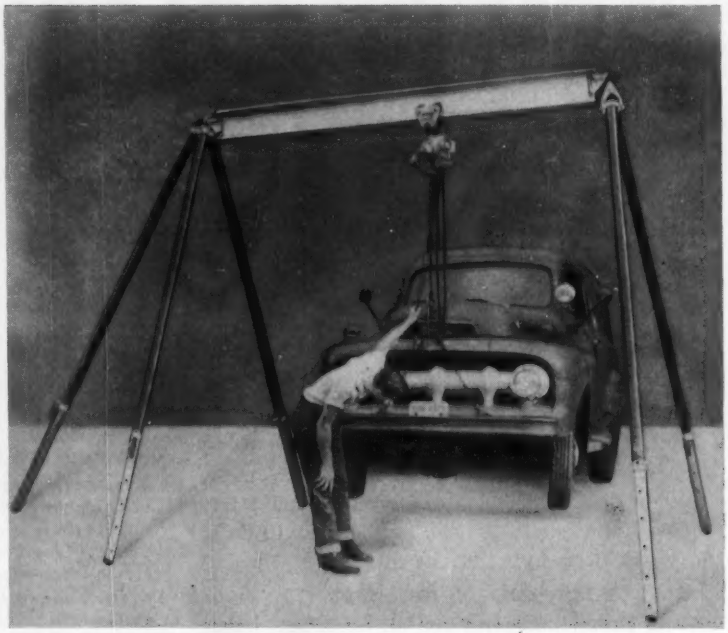
Johns-Manville
SEALING COMPOUNDS



15-Kv Current Transformer

This 15-kv indoor current transformer for switchgear applications is available in all standard ASA current ratings from 15:5 to 800:5 amp. The 47-lb butyl-molded unit, known as JKS-5, has frequency of 25/60 cycles. Thermal rating is 100% of rated current with 55C ambient and 133% of rated current with 30C ambient.

General Electric Co, Schenectady 5, N. Y.



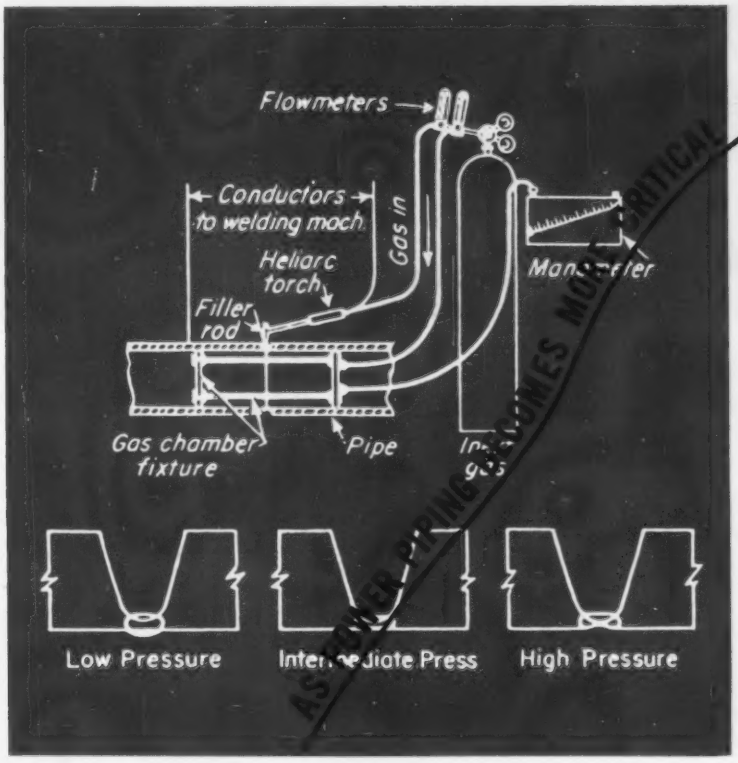
Portable Gantry

This portable gantry employs an aluminum alloy I-beam supported by a tripod and an A-frame. Leg length is adjustable by as much as 7 ft, and the supports can also be used individually.

The corrosion-resistant unit has maximum capacity of 4,000 lb. It is available in heights up to 17 ft and with I-beams as long as 20 ft. Manufacturer says the gantry can be easily stored, moved and erected.

B. E. Wallace Products Co, Exton 20, Pa.

(*More New Equipment on page* 134)



KELLOGG'S FIELD WELDING TECHNIQUES KEEP PACE

With main and reheat steam piping for steam-electric power plants becoming heavier and more difficult to handle because of increasing wall thicknesses, more and more of the welding previously done in fabricators' shops must be handled in the field. This, coupled with the need for still better welding techniques to combat higher operating pressures and temperatures, demands even higher standards of design and workmanship to compensate for the less favorable conditions often encountered in the field.

One way in which M. W. Kellogg sets the pace in field fabrication is with K-Weld*—Kellogg's unique inert gas shielded technique of arc welding. With K-Weld, complete penetration and a highly uniform internal contour are assured without the use of backing rings. Incorporating a Kellogg development which controls internal gas pressure and shape of the interior weld surface automatically, K-Weld is recognized as the ultimate in welding techniques for any type or size of alloy piping—both for shop and field fabrication.

A 12-page booklet, "For The Modern Central Power Station," describes K-Weld and other M. W. Kellogg facilities for the design, fabrication, installation, and testing of main and reheat steam piping.

K-Weld root bead is laid while the pipe interior is under controlled inert gas pressure in the gas chamber fixture. Diagram at top of page shows detail of this portable gas chamber fixture and how interior weld surface is controlled by varying pressure.

K-Weld is always under the supervision of a Kellogg inspector, supplementing final radiographic inspection. In addition, a permanent chart record is made on the potentiometer of all steps in welding and stress relieving.

FABRICATED PRODUCTS DIVISION
THE M. W. KELLOGG COMPANY, 711 THIRD AVENUE, NEW YORK 17, N. Y.
The Canadian Kellogg Company, Ltd., Toronto • Kellogg International Corporation, London
SUBSIDIARIES OF PULLMAN INCORPORATED

*Trademark of and patented by The M. W. Kellogg Company

POWER PIPING—THE VITAL LINK

"We prevented Field complaints and motor Burnouts — by protecting our sewing machine drive motors with FUSETRON FUSES."

"By 1949, increased sewing machine speed and stepped-up production tempo were putting an added burden on the drive motors we make for Singer Sewing Machine Co.

"It was necessary to find a more effective way to protect these industrial sewing machine motors — otherwise, we might expect increasing motor burnouts and field complaints.

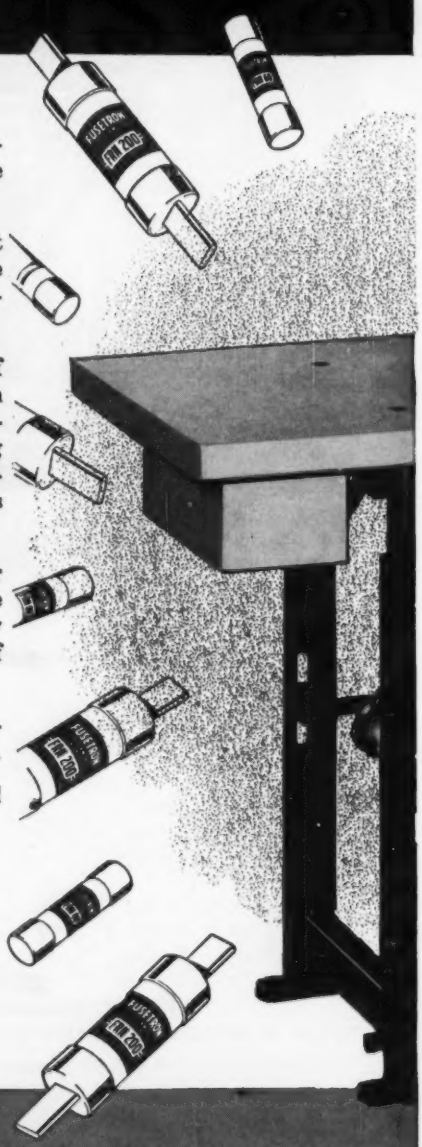
"An extensive test was conducted on the application of Fusetron dual-element fuses of motor-running protection sizes. Our investigation showed that Fusetron fuses, because of their time-lag, would hold the motor starting current. They also would absorb the current surges resulting from starting the sewing machines 40 or more times per minute.

"In addition, Fusetron fuses would safely take the motor off the line if the branch circuit was single phased. We were particularly interested in this finding because we knew this type of power supply fault could give us a lot of trouble.

"On the basis of our tests, we decided to provide individual Fusetron fuse protection as standard equipment.

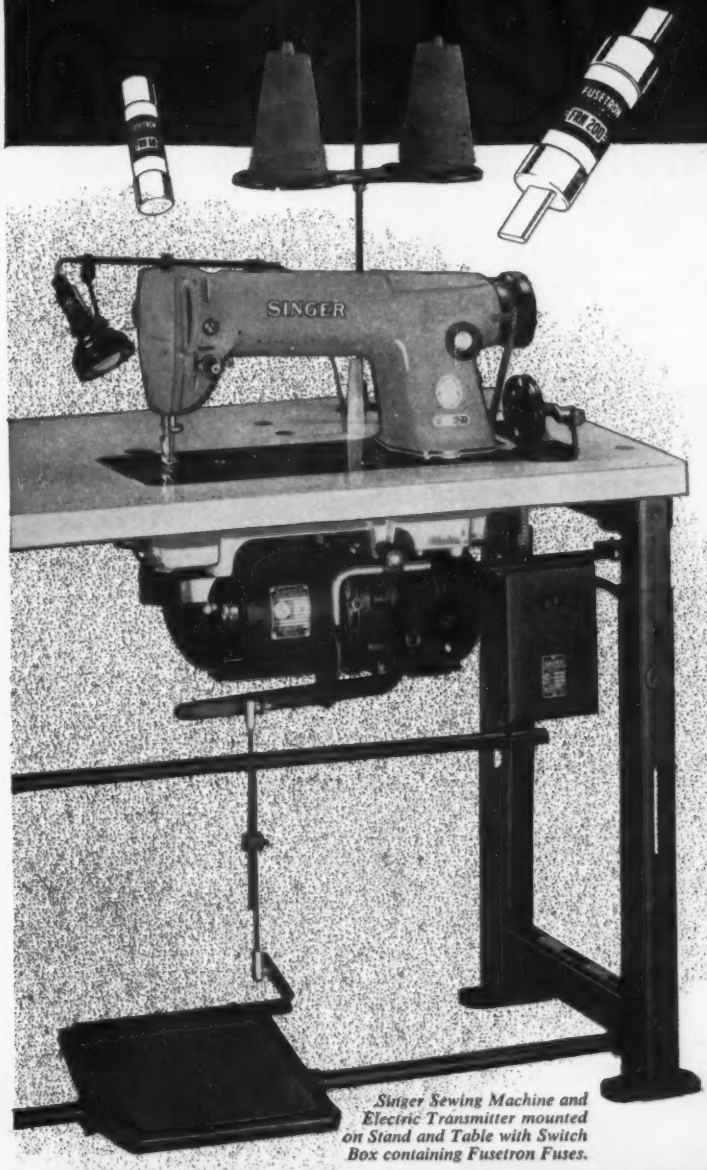
"As we expected, this decision practically eliminated motor burnouts and prevented field complaints."

R. D. Ingalls,
CHIEF ENGINEER
DIEHL Mfg. Co.
Electrical Division of
The Singer Manufacturing Co.
SOMERVILLE, N. J.



***Play Safe!* install Fusetron Fuses and BUSS Hi-Cap Fuses throughout the entire Electrical System.**

You too, can eliminate Protection Troubles with FUSETRON FUSES . . .
They provide 10 point protection.



Singer Sewing Machine and Electric Transmitter mounted on Stand and Table with Switch Box containing Fusetron Fuses.

1. High interrupt capacity — protect against heavy short-circuits. Have proven on tests to open safely on circuits set to deliver in excess of 100,000 amperes.
2. Protect against needless blows caused by harmless overloads.
3. Protect against needless blows caused by excessive heating — lesser resistance results in cooler operation.
4. Provide thermal protection — for panels and switches against damage from heating due to poor contact.
5. Protect motors against burnout from overloads.
6. Protect motors against burnout due to single phasing.
7. Give DOUBLE burnout protection to large motors — without extra cost.
8. Make protection of small motors simple and inexpensive.
9. Protect against waste of space and money — permit use of proper size switches and panels.
10. Protect coils, transformers and solenoids against burnouts.

FOR LOADS ABOVE 600 AND UP TO 5,000 AMPS., . . . *Use BUSS Hi-Cap Fuses*

They have an interrupting capacity sufficient to handle any fault current regardless of system growth.

They can be coordinated with Fusetron fuses on feeder and branch circuits to limit fault outages to circuit of origin.

On new construction, tell your architect to specify this Safer, Better Protection.

456

For detailed information on Fusetron dual-element fuses and BUSS Hi-Cap fuses, write for bulletin FIS and HCS.

BUSSMANN MFG. CO. (Division of McGraw Electric Co.)
UNIVERSITY AT JEFFERSON ST. LOUIS 7, MO.

FUSETRON
TRUSTWORTHY NAMES IN ELECTRICAL PROTECTION
BUSS

Why Pay 3 MEN to Watch Your Line Crew Work?

START SAVING TIME and MONEY with

TEL-E-LECT 2-MAN UTILITY RIGS

If you're using 5-man crews and old fashioned utility equipment (even on '55 chassis) you've got *three extra men on most jobs!*

With Tel-E-Lect equipped trucks you'll discover the great time and money saving advantages of 2-man construction trucks. Leading public utility companies throughout the country are now using 2-man trucks to do a large share of the work once performed by 5-man crews—and they're realizing increased profits in the process.

Your 2-man crew won't work any harder, but they'll produce more and do it faster than many 5-man crews. You see, Tel-E-Lect builds the services of three men into its utility truck equipment. Tel-E-Lect equipment provides new power features that require only two men to perform the tasks once done by five!

The 2-man construction equipment described here lets you put smaller crews on everyday jobs while freeing big crews and big equipment for the really tough highline jobs.

THE TEL-E-LECT COMBINATION BODY

This *complete* package consists of a rugged steel body, stowaway derrick, winch and drive, pole hole digger and drive and rapid forward-reverse transmission. Three simple installation steps by your local mechanic puts the Combination Body on your truck chassis regardless of make or model. You simply install power take-off . . . mount body and connect power drive . . . and install cab controls. It's now ready to go to work!

A Tel-E-Lect all steel Combination Body is completely equipped with Stowaway derrick, digger and power units—a model 2-man construction truck.

Front mounted Tel-E-Lect "T" frame derrick and Tel-E-Lect Pole Hole Digger gives this utility truck 2-man versatility.

WINCH, DIGGER AND DRIVE KITS FOR ALL POPULAR-MAKE TRUCKS

A series of easily installed Tel-E-Lect kits make it possible to install derricks, diggers and power drives at the front of your present utility truck. The flexibility and economy of 2-man operation can be extended to any size or model of International 4x4, Ford, Chevrolet, GMC, Dodge or other truck.

These Tel-E-Lect kits are designed specifically for the particular truck on which they will be installed. Each kit contains every part needed for easy installation by your local mechanic.

TEL-E-LECT SELF-STORING DERRICK CONVERSION KITS

An entirely new concept of derrick storage eliminates the hazards once involved in derrick erection and take-down. Your front mounted "A" or "T" frame derrick stores on top of the truck—doesn't use valuable body space for storage.

Your truck's winch supplies power to raise or lower derrick. With a double drum winch you'll get "live-boom" flexibility and with a single drum winch you'll get easily adjustable derrick elevation! This low cost unit fits any truck with or without body and is quickly installed.

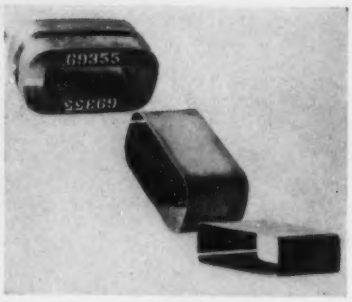
This 2-man construction truck features a front mounted Tel-E-Lect T-45 derrick and Tel-E-Lect Self Storing Derrick Conversion. The derrick is shown in its stored position in the smaller photo.

Tel-E-Lect provides other kits for individual requirements. Write us about any of your utility truck problems.

TEL-E-LECT PRODUCTS, INC.

TEL-E-LECT PRODUCTS, INC.

10,003 Minnetonka Blvd., Minneapolis 26, Minnesota



Wound-Core Design

A wound core, presently incorporated into 3 through 50-kva distribution transformers, reportedly gives low loss, permanent performance, and trouble-free operating characteristics.

The development consists of a core of single-turn laminations with staggered butt joints. This is said to provide a core that is compact, free of joint bulges, and easily assembled and disassembled. Finished core and two laminations are illustrated.

The manufacturer's regular five-year product warranty applies to the new core.

RT&E Corp, 1900 E. North St, Waukesha, Wis.

Adjustable Manhole Shield

Surface water and dirt are kept out of an open manhole by this adjustable shield. It is 12 in. high, weighs 40 lb, and is made of electrically welded steel.

Clamps on the shield permit ready adjustment to fit manhole frames up to 36 in. diam. It is usually caulked in place with plaster of Paris which provides an effective seal and can be cleaned off easily.

T. J. Cope, Inc, Collegeville, Pa.

(*More New Equipment on page* 134)

Weather-protected by this exclusive design

KEARNEY TRIPOMATIC ENCLOSED CUTOUTS

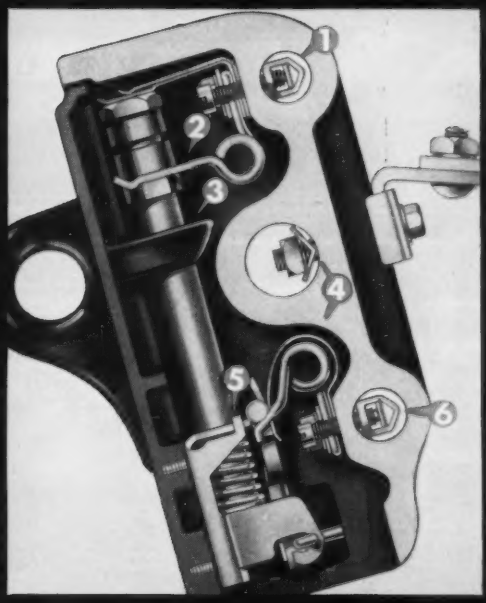
The exclusive design of the wet process porcelain housing of the KEARNEY Tripomatic provides greatest possible weather protection. The lead-in holes for the back connected terminals are isolated from the cartridge chamber by a porcelain wall. This feature eliminates the source of most dirt deposits inside the box, and keeps out rain and snow.

Contacts and hanger bracket are not "cemented on" but *bolted through* the porcelain wall . . . so they can never pull out of the housing.

design features . . .

Continuous research, development and testing brought these important features out of the laboratory. Consistent manufacture keeps Tripomatic quality at the highest level.

1. Stirrup type terminals are fully plated. 50 ampere cutouts take No. 2 str.; 100 ampere ratings take No. 1/0 str.
2. Resilient spring contacts absorb tube thrust when fuse link blows. Maintain high pressure contact after long service.
3. High gas barrier and matching tube guide prevent short circuits between contacts. Gives extra leakage distance.
4. Hanger bracket, contacts and terminals are attached to the housing by through bolts. They can never pull out.
5. Spring backed toggle mechanism assures positive dropout.
6. Lead-in holes are external to cartridge chamber, to keep dirt and moisture out of the inside of the housing.



JAMES R. KEARNEY CORP. 4224-42 Clayton Avenue • St. Louis 10, Mo., *Canadian Plant:* Guelph, Ontario

320

for BETTER CONSTRUCTION
SAFER MAINTENANCE
Specify

JAMES R. KEARNEY CORPORATION ST. LOUIS MO. GUELPH, ONT.

KEARNEY PRODUCTS

The Mark of Quality

Champs
with
CHEVROLET
CHEVROLET
NEW CHEVROLET

These new Task-Force jobs pack the biggest power punch in Chevrolet truck history with the most modern engines in the industry! They're the new champs of every weight class with a V8 for every model and an automatic drive for every series!

a new power punch!

HIGH-POWERED V8's throughout the line!

They're standard in all L.C.F.'s and new heavyweight haulers (extra cost in other models). The big new 322-cu.-in. Loadmaster provides the short-stroke power punch in top-tonnage L.C.F.'s and in other models rated up to 32,000 lbs. G.V.W., 50,000 lbs. G.C.W.! Famous Task-Force sixes—more powerful than ever—keep rolling with traditional economy!

WORK-SAVING automatic drives in every series!

There's revolutionary new Powermatic with 6 fully automatic forward speeds, available for most middleweights and heavies! Hydra-Matic for all truck models rated up through 1½ tons! Both are extra-cost options. See your Chevrolet dealer for details on the right Task-Force model for your job!... Chevrolet Division of General Motors, Detroit 2, Michigan.

Anything less is an old-fashioned truck!

TASK·FORCE TRUCKS

If you buy distribution transformers

HERE ARE FIVE THINGS YOU SHOULD KNOW

1. Who is RT&E?

A 10 year old manufacturer of distribution transformers, located in Waukesha, Wisconsin. It s personnel have hundreds of years of experience in designing, building and servicing the finest distribution transformers.

2. How big is RT&E?

Not as big as the giants, yet very big in ability, in performance, in engineering and in service. Small enough to value every customer, big enough to service the entire nation.

3. What does RT&E make?

Distribution Transformers in all styles from 3 thru 500 KVA.

4. Are RT&E Transformers different?

Yes, RT&E has pioneered most of the new features of the last 10 years, such as the *Externally Operated Tap Changer, Wick-fed Oil filled Bushing, Balanced Construction Wound-Core* and the *Spiral-Groove Lightning Arrester.*

5. Are RT&E Transformers dependable?

Yes, RT&E is the manufacturer that initiated the FIVE year Guarantee as proof of dependability.

To get the best buy for your company, send for complete details on RT&E's outstanding products.

RT&E CORPORATION
WAUKESHA WISCONSIN

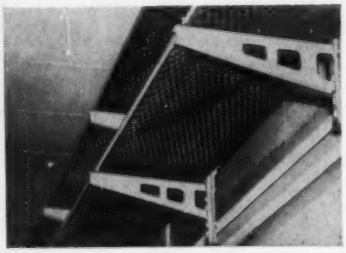
Power Conversion Units

A line of selenium ac to dc power conversion units has been extended to include ratings of 50, 75, 100 and 125 kw. Each rating is offered in either 125 or 250 v dc, with other voltage ratings available on special order.

Manufacturer claims the larger single-unit ratings provide cost savings of 10% and up to 100% saving in floor space. The large single units also reportedly require less maintenance and are easier to install than small multiple units.

Construction features include Vac-u-Sel rectifier stacks and the absence of moving parts except for ball bearings in the cooling fans.

General Electric Co, Rectifier Department, Lynn, Mass.



Cantilever-Type Support

This cantilever-type support has been designed for a metal cable trough supporting system. Manufacturer reports that a twist of the wrist is sufficient to secure the Rakit support arms to which the cable trough is bolted. The Rakit arms are secured to upright channel irons with prepunched holes that provide a wide number of possible settings.

With the cantilever type of arm, cable can be lifted over the side of the trough without any interference from uprights supporting the arm.

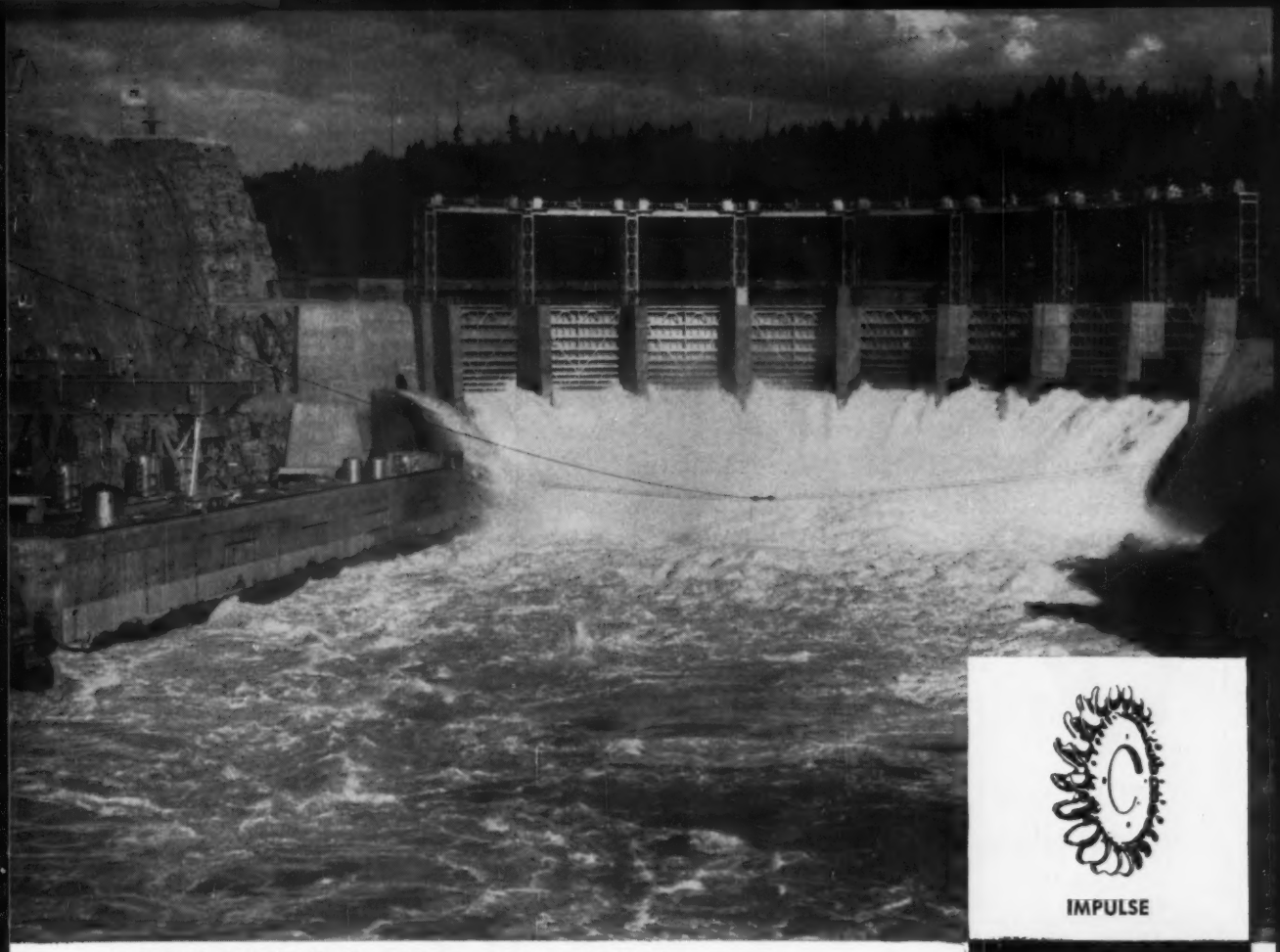
T. J. Cope, Inc, Collegeville, Pa.

Fluorescent Fixture

A fluorescent fixture, known as Fluoroflood, is designed for outdoor lighting applications. The 8-ft rapid-start lamp generates 7,250 initial lumens, manufacturer says.

An acrylic plastic cover is available for use with the unit and is recom-

(*Continued on page* 136)



Hydroelectric plant of The Washington Water Power Company at Cabinet Gorge. Three BLH fixed blade propeller turbines and one BLH Kaplan turbine produce 282,000 hp here.

how BLH can help solve your turbine problems

Here are four ways we can help you:

- We have excellent hydraulic laboratories for testing scale models under simulated operating conditions. Laboratory tests assure proper design of turbines to meet your specific conditions.
- Eddystone and Pelton Divisions of BLH Corporation have been designing and building turbines since 1841. There's no substitute for experience, and our experience is all yours to command.
- We build all four basic turbines—Impulse, Kaplan, Francis and Propeller type. You can be sure that our recommendations are objective.
- We manufacture surge suppressors, valves, pumps, governors and other accessory equipment. You place all responsibility in one source of supply.

Would you like a copy of our 22-page catalog illustrating and describing our hydraulic power equipment and typical installations? Write to BLH Corporation, Philadelphia 42, Pennsylvania, or Dept. 5007, Pelton Division (BLH), 2929 Nineteenth Street, San Francisco 10, California.

EDDYSTONE DIVISION
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DIVISIONS: Austin-Western • Eddystone • Hamilton • Electronics & Instrumentation • Lima • Madsen • Loewy-Hydropress • Pelton • Standard Steel Works

MR. CARNEY answers the $1,929,880 question!

"Since 1946, we have accumulated a total estimated revenue of $1,929,880 on commercial electric cooking," says Mr. H. E. Carney, Manager, Commercial Department, Toledo Edison Company, Toledo, Ohio

READ MORE ABOUT the utilities' "poor little rich load"

"This revenue has been produced at a total cost of only $125,000," says Mr. Carney. "Our ultimate aim on Commercial Electric Cooking is a 2,500 kw per year increase until 1960. Then we will hit for a 3,000 kw per year increase. The demands on our plant and distributing system are so diversified that commercial cooking load seems to be a high-profit load having a high utilization. The all-electric restaurant is the perfect customer. He has good lighting, good summer air conditioning, and continuous year 'round electric cooking. His demand in ratio to connected load is as low as any other kind of customer. His hours use of demand are long. Is it any wonder that we prize such a customer?"

Other top utility executives report as follows:

Mr. B. L. England, President, Atlantic City Electric Co., Atlantic City, N. J., says: "Commercial cooking load diversifies well with other classes of business and provides us with favorable revenue expressed in terms of system demand responsibility."

Mr. Roy S. Nelson, President, Gulf States Utilities Co., Beaumont, Texas, says: "We are most enthusiastic about our commercial electric cooking sales promotion as the equipment produces a fairly high annual revenue per kw of maximum load and offers the customers many benefits over other types of cooking."

You'll find more of these facts, directly from utility men, in the 12-page study made by ELECTRICAL WORLD, which reveals startling facts about Commercial Electric Cooking. For example:

- There are well over ½ million outlets for Commercial Electric Cooking equipment.
- The market is barely scratched—saturation as low as 5% to 15% in some areas.
- The estimated annual revenue from one small fry kettle equals that from four household ranges.

Read the story for yourself in this revealing report. Just have your secretary write to us today for:

COMMERCIAL ELECTRIC COOKING —THE UTILITIES' POOR LITTLE RICH LOAD

(There's no charge)

For the answers to specific questions, please communicate with any of the member companies listed below.

COMMERCIAL COOKING EQUIPMENT SECTION
National Electrical Manufacturers Association • 155 East 44th Street, New York 17, N. Y.

ASSOCIATED PRODUCTS, INC. • CORY CORPORATION • GRISWOLD MANUFACTURING CO.
HOTPOINT COMPANY • MARKET FORGE CO. • ROYCE L. PARKER, INC.
SAVORY EQUIPMENT, INC. • THE SILEX COMPANY • STAR MANUFACTURING CO.
TOASTMASTER PRODUCTS DIVISION McGRAW ELECTRIC COMPANY
WELLS MANUFACTURING CO. • EDWARD L. WIEGAND CO.

Fluorescent Fixture

(*Continued from page* 134)

mended for installations in cold climates. The 7-lb fixture is designed to house the 96T12/CW/RS rapid-start fluorescent lamp which has been engineered for outdoor cold weather applications. For more data, request Bulletin GEA-6436A.
General Electric Co, Outdoor Lighting Dept, Hendersonville, N. C.

MORE NEW PRODUCTS

Westinghouse Electric Corp, Lighting Division, Cleveland, Ohio, has an adjustable **general purpose floodlight** (Type ARC-20). The waterproof unit can be used with 700-w A-H18 or B-H18 mercury lamps or 1,000-w A-H15 mercury lamps.

Mitchell-Rand Insulation Co, Inc, 52 Murray St, New York 7, N. Y., offers three types of **epoxy resins.** Randac R-4060 is a rigid-type casting or embedding resin; R-4059 is a semi-flexible-type casting resin; and R-4053 is a "hot-melt" dip coating and sealing resin.

Eastern Aerosol Products, Newfoundland, N. J., has a **rust preventive spray** for use on tools, instruments, and motors. The compound, known as Rust Chek, is packaged in a 12-oz aerosol spray container. It provides about 80 sq ft of coverage in form of a clear, dry, waxy film.

Frederick Post Co, 3666 N. Avondale Ave, Chicago 18, Ill., has two **mathematical calculating charts** that are said to serve same purpose as a slide rule. The charts, on heavy 8½ by 11-in. card stock, consist of a log scale superimposed diagonally upon a log log grid.

C. F. Pease Co, 3931 N. Rockwell St, Chicago 18, Ill., has two **42-in. whiteprinting machines** that will expose and develop ammonia-type whiteprints up to 32 ft per min.

Signal Transformer Co, 2518 Coney Island Ave, Brooklyn 23, N. Y., is using new manufacturing methods for size and weight reduction in its line of **transformers up to 2 kva.**

(*Continued on page* 138)

NEOPRENE or POLYETHYLENE
Self Supporting Service Cable

Southwire...a name synonymous with service...offers a complete range of self supporting service drops to meet every possible need.

AAC...ACSR...or Copper. In every combination to customer specifications. All are manufactured, from start to finish, in our own modern plant.

Southwire Neoprene or Polyethylene is especially designed for low-voltage installations. Every service drop meets or exceeds ASTM specification.

Whatever your requirements, specify Southwire and get the fastest, most reliable delivery possible—by our own fast fleet of trucks.

SOUTHWIRE PRODUCTS

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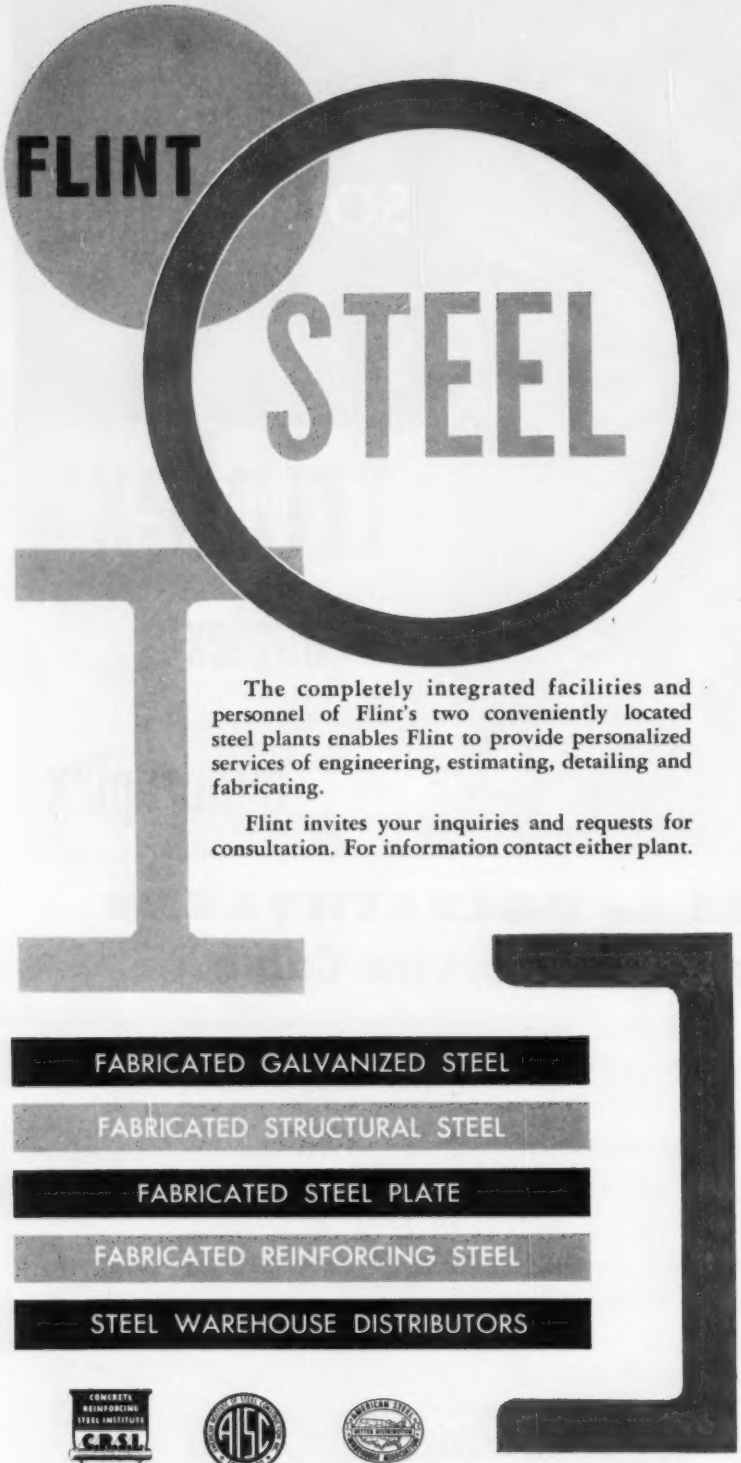
- Neoprene Weatherproof Copper, Aluminum and Triplex
- Polyethylene Weatherproof Copper, Aluminum and Triplex
- Southwire Vinyl Weatherproof Copper, Aluminum and Triplex
- Copperweld® Conductors
- Copper and Aluminum Building Wire
- ACSR and All Aluminum Cable
- Steel Guy Strand and Static Wire
- Aluminum Alloy Wire
- Cable Accessories

Southwire Company

Terrace 2-6311 CARROLLTON, GEORGIA

"SOUTHWIRE MEANS SERVICE"



The completely integrated facilities and personnel of Flint's two conveniently located steel plants enables Flint to provide personalized services of engineering, estimating, detailing and fabricating.

Flint invites your inquiries and requests for consultation. For information contact either plant.

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FABRICATED REINFORCING STEEL

STEEL WAREHOUSE DISTRIBUTORS

for over 40 years

FLINT STEEL CORPORATION

TULSA . . . MEMPHIS

More New Products

(*Continued from page* 136)

General Electric Co, Wire & Cable Dept, Bridgeport, Conn., has **BX armored cable** with thermoplastic insulation on individual conductors. Rated 600 v, it is available in 2, 3 and 4 conductors in standard sizes.

American Machine & Foundry Co, 261 Madison Ave, New York 16, N. Y., has an **electrically insulated metal foil** called Amfoil. It consists of various metal foils coated on one or both sides with Teflon, DuPont's high-temperature dielectric.

Leece-Neville Co, 1374 E. 51st St, Cleveland 3, Ohio, has developed **rectangularly shaped motors** to give same output as comparable conventional round motors. The line is available in 6, 12, 24 and 32-v ranges with outputs up to 140 oz-in.

Crouse-Hinds Co, Syracuse, N. Y., has a dust-tight, explosion-proof flexible cushion **fixture-hanger.** The stem can be moved 15 deg from vertical while supporting 65 lb.

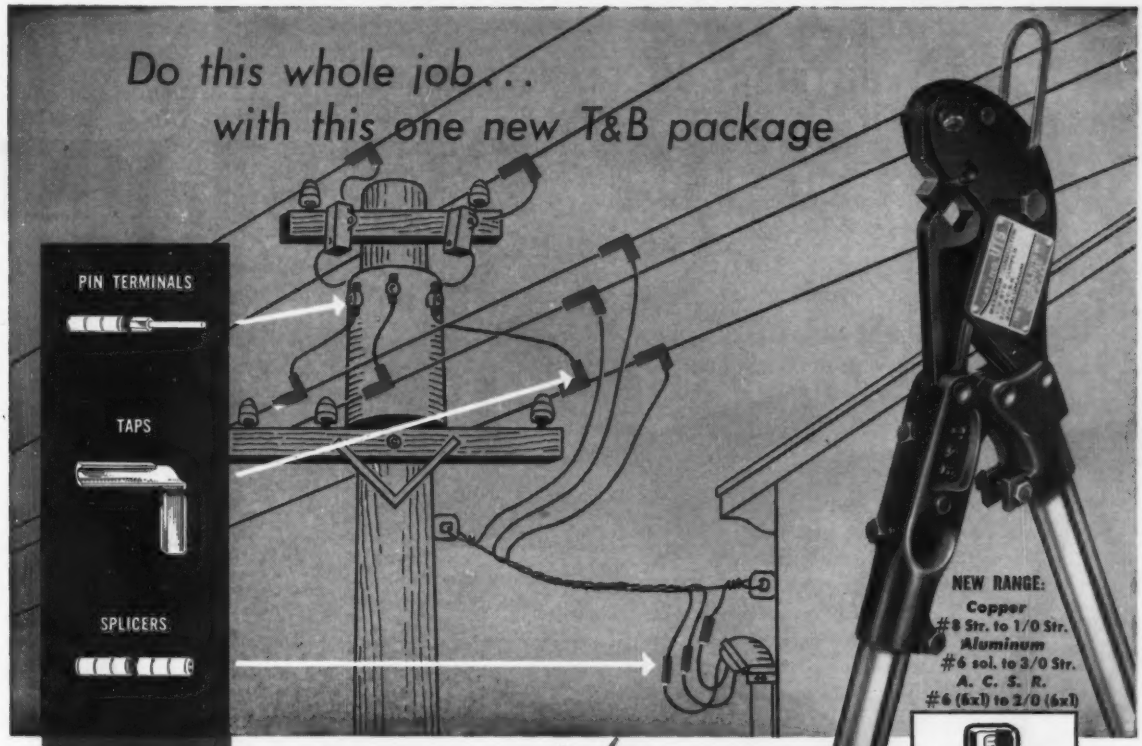
Minneapolis-Honeywell Regulator Co, 2753 Fourth Ave South, Minneapolis, Minn, has an electronic thermostat that features a **27-ft temperature-sensing element** enclosed in ⅛-in. copper tubing. Operating range is from −30 to 225F.

Hobby & Brown Electronic Corp, 55 Front St, Rockville Centre, N. Y., has an **automatic emergency floodlight** with an automatic recharger. The unit uses 2 5,000-cp lamps which illuminate 10,000 sq ft for 12 hr.

Steber Mfg Co, 2700 Roosevelt Rd, Broadview, Ill., has a **fluorescent lighting fixture** (Skyliner T) for outdoor work areas. It is available in 4, 8, 12 and 16-ft sections.

DeVilbiss Co, Toledo, Ohio, has a portable **paint-heating unit** for spraying under low temperature conditions. It is mounted on a 2-wheel cart.

Kolton Electric Mfg Co, 123 New Jersey Railroad Ave, Newark 5, N. J., has a line of terminal and **conduit boxes** for electric motors. The drawn steel boxes are available in 4 sizes from ½ to 3 in.



NEW!

T&B complete COLOR CODED splicing package speeds line and service work

Now one new UT 5 installing tool is the *only* tool you need to make all line and service compression connections . . . including splicers, taps, and pin terminals. And T & B's color-coding insures accurate, speedy connections on a wide range of copper, aluminum and A. C. S. R. cable.
Here's all you do . . . match the color of the die to the color of the connector . . . compress . . . and the joint is made.

Your T & B Distributor will be glad to demonstrate the UT 5 with its many advantages. When you use this one tool you simplify all your line and service work.
For further information write for new T & B bulletin.

LOOK FOR THIS SIGN — T&B ENGINEERED

IT'S THE MARK OF AN AUTHORIZED T & B DISTRIBUTOR

The complete line of T & B fittings for conductors and raceways is sold only by recognized electrical wholesalers. It's our way of assuring you the service and savings of a friendly local source. Call him for all your electrical needs. T-61

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MANUFACTURERS OF FINE ELECTRICAL FITTINGS SINCE 1898

DISTRIBUTION TRANSFORMERS

THIS PAINT

COULD SAVE YOU $15 to $160

Estimate your possible savings in terms of all transformers on your lines

Super Melaglyp, the new G-E paint, gives 50 per cent longer life than the previous finish under normal conditions, and up to 150 per cent longer life under corrosive conditions. This longer paint life means that you save one, perhaps two repaintings. At an average repainting cost of $15 per transformer, that amounts to a real saving.

In areas where corrosive industrial "smog" and other chemical fumes literally eat an ordinary finish down to the base metal, Super Melaglyp makes possible even more dramatic savings. For ordinary paints under such conditions may even cause a transformer to fail. In one case, a 5-kva, 7200-volt transformer, battered by spray in a remote seacoast location, rusted, leaked, and failed. Cost of service trip plus replacement added up to $160.

Developed in G-E laboratories after more than four years of experimentation, we believe Super Melaglyp is by far the best outdoor finish available today for distribution transformers.

Look at the other money-saving features that prove "All Transformers Are Not Alike": **Impulse testing,** for instance, saves years of transformer life. One-piece **clamping bands** save maintenance time. Reuseable **Nitrile rubber gaskets** save units from contamination. **AL/CU terminals** are designed to prevent both copper and aluminum conductors from loosening. **Strenicor clamps** save terminals from breaking. **Nationwide warehouses** save utilities inventory expense. **Service shops** can cut your repair and rebuilding costs.

For the complete story contact your nearest G-E Apparatus Sales Office or G-E Agent—or write to General Electric Co., Schenectady 5, N. Y. 431-38

dollar-saving features prove ATANA*

*ALL TRANSFORMERS ARE NOT ALIKE
(make this simple comparison and see)

FEATURE	General Electric	Mfr. A	Mfr. B	Mfr. C	Mfr. D	Mfr. E
Production-line impulse testing	√			√		√
Nitrile rubber gaskets	√					√
One-piece clamping band	√					
H-v and l-v terminals handle both copper and aluminum conductors	√					
Strenicor pressure terminal clamps	√					
Super Melaglyp paint	√					
More than 100 warehouses	√	√				
Nationwide, company-operated service shops	√	√				

Progress Is Our Most Important Product

GENERAL ELECTRIC

malleable iron

HIGH CORROSION RESISTANT

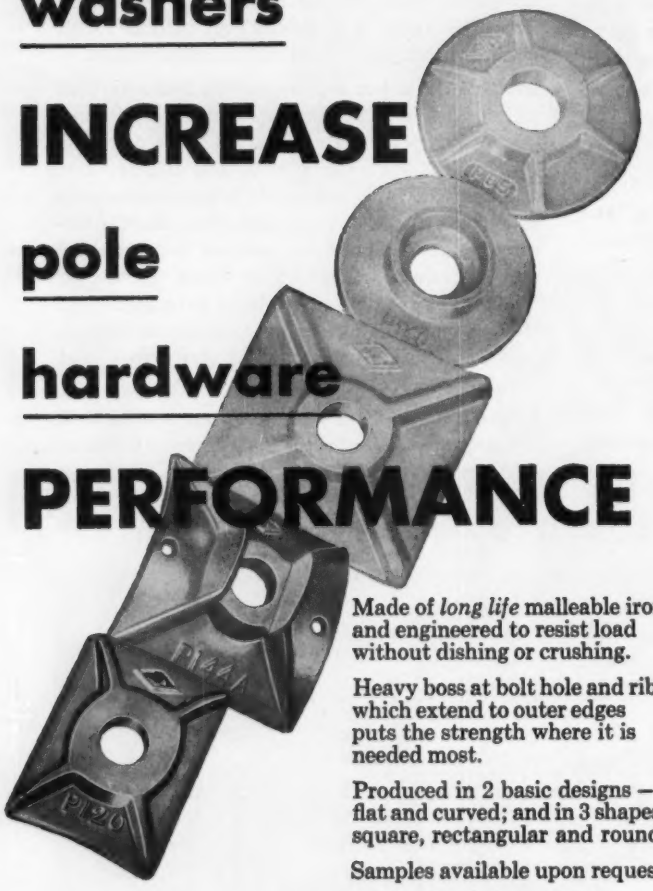
washers

INCREASE

pole

hardware

PERFORMANCE



Made of *long life* malleable iron and engineered to resist load without dishing or crushing.

Heavy boss at bolt hole and ribs which extend to outer edges puts the strength where it is needed most.

Produced in 2 basic designs — flat and curved; and in 3 shapes, square, rectangular and round.

Samples available upon request.

For further information Write for Bulletin PH 5

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CATALOGS—BULLETINS

• **GERMANIUM RECTIFIERS:** Design, construction and application data on germanium rectifiers for industrial use are given in 10-page Bulletin No. 1204. General Electric Co, Schenectady 5, N. Y.

• **RESIDENTIAL LIGHTING:** Bulletin No. 31-F-23 has 44 pages and nearly 200 pictures of a residential fixture line. Globe Lighting Products, Inc, 1710 Flushing Ave, Brooklyn 37, N. Y.

• **OUTDOOR MOTORS:** Construction features of a line of weather-protected motors, 250 hp and larger, for outdoor installation are described in Bulletin No. 05B7874B. The 6-page booklet portrays mechanical features of the line by means of a cross section diagram of a 700-hp squirrel-cage induction machine. Allis-Chalmers Mfg Co, 932 S. 70th St., Milwaukee, Wis.

• **RECORDING INSTRUMENTS:** Electronic potentiometer and bridge instruments for recording and controlling are described in 64 page Bulletin No. P1245A. Bristol Co, Waterbury 20, Conn.

• **LAMPS:** General principles of lamp design and operating characteristics of incandescent, mercury vapor and fluorescent light sources are discussed in Bulletin LD-1. Charts and photographs are included in the 80-page booklet. General Electric Co, Nela Park, Cleveland 12, Ohio.

• **DISTRIBUTION TRANSFORMERS:** Bulletin No. 3-500 provides design and product data on single and 3-phase distribution transformers with h-v ratings from 480 to 15,000 v. The 32-page booklet contains 60 tables giving kva ratings, physical dimensions, weights, losses, efficiencies, and regulation data. Federal Pacific Electric Co, Gardner Transformer Division, Emeryville 8, Calif.

• **WATER-HEATING LOAD:** Time switches and a combination watthour meter-time switch for registration and control of off-peak water-heater load are described in 12-page Bulletin No. GEC-981A. General Electric Co, Schenectady 5, N. Y.

• **NETWORK TRANSFORMERS:** Operating features of a line of oil and Chlorextol liquid-filled and sealed dry-type transformers are discussed in 24-page Bulletin No. 61B6152B. It describes the electrical assembly of the units, tap changer and tank design, and construction, mechanism and accessories of the transformers. Allis-Chalmers Mfg. Co, 968 E. 78th St., Milwaukee, Wis.

• **TRUCK SERVICING:** Form 5097-10 is a 32-page truck service guide. It gives time and cost comparisons in doing a number of common service jobs by hand and with electric power and air tools. Specifications and capacities for each of the power tools are given. Ingersoll-Rand Co, 11 Broadway, New York, N. Y.

• **SHOPPING CENTERS:** Intergration of various electric products into the design of an efficient shopping center is subject of Booklet No. B-6595. The 32-page publication gives applications of such equipment as switchgear and distribution apparatus, luminaries, electric stairways, and air conditioners. Westinghouse Electric Corp, P. O. Box 2099, Pittsburgh 30, Pa.

We broke these truck axles in the lab...

In the INTERNATIONAL Engineering Laboratory, axle shafts are tested by twisting them back and forth—hundreds of times—at stress points far beyond those of any normal truck operation. Axle shafts are approved for manufacture only when they withstand a prescribed high number of twists. Production line axle shafts must conform to the quality standards set up by this rigid test.

to save you the BIG money!

Pictured above is a group of once fine and costly INTERNATIONAL axle shafts that have been purposely twisted and broken. This is done to make sure your INTERNATIONAL rear axle will last longer and save you the BIG money—the over-the-years operation and maintenance money.

This rigorous axle-twist test is but one of many operations in the chain of INTERNATIONAL engineering that makes INTERNATIONALS *all-truck*. There are no passenger car compromises *anywhere* in INTERNATIONAL design, no passenger car engines or components asked to do a truck job.

And beyond this big plus of all-truck design, INTERNATIONAL gives you functional, practical, money-saving styling—extra comfortable driver-saving cabs—every modern driving feature.

If you use a truck to make money, see your INTERNATIONAL Dealer or Branch and start saving the BIG money!

For line construction, service, crew transportation—for any public utility job—INTERNATIONAL has the truck best suited to the operation, including a popular light-duty four-wheel-drive model.

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Motor Trucks • Crawler Tractors • Industrial Power
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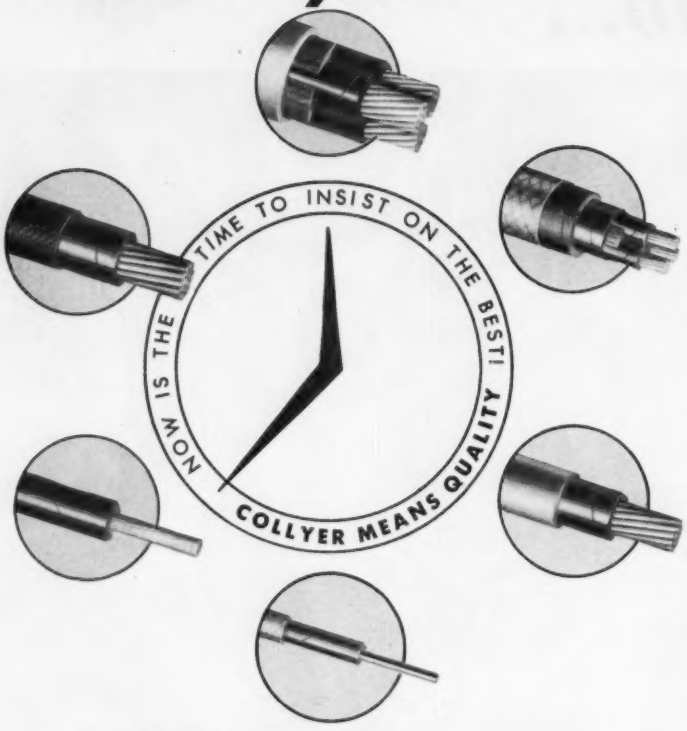
IT'S *Collyer* TIME!



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Asbestos Insulated Wires and Cables
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Heavy Duty Portable Cables and Cords
High Voltage Cables
Lead Sheathed Cables
Line Wire
Machine Tool Wires
Mining Machine Cables
Motor and Generator Leads
Network Cables
Neutral Supported Service Cables
Non-Metallic Sheathed Cable (Cablex)
Pole and Bracket Cables
Resistol* Insulated and Sheathed Cables
Rubber Insulated Power Cables
Service Cables
Station Control Cables
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Switchboard Wires and Cables
Tree Wire
Underground Cables
Varnished Cambric Insulated Wires and Cables
Welding Cables

*Resistol is Collyer's Polyvinyl Thermoplastic Resin

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BOOKS

Received Since March 28

Materials Handbook. By George S Brady. Published by McGraw-Hill Book Co, 330 W. 42nd St, New York 36, N. Y. 1022 pages.. Price $11.00.

Engineering in History. By Richard Shelton Kirby, Sidney Withington, Arthur Burr Darling, Frederick Gridley Kilgour. Published by McGraw-Hill Book Co, 330 W. 42nd St, New York 36, N. Y. 530 pages, illustrated. Price $8.50.

Possibilities of Action in the Field of Nuclear Energy. Published by Organization for European Economic Co-operation. Available at O.E.E.C. Publication Office, 2002 P St N W, Washington 6, D. C. 72 pages, illustrated. Price $1.00.

Mathematische Methoden in der Hochfrequenztechnik. By Klaus Paschl. Published by Springer-Verlag, Berlin W 35 Reichpletschufer 20, West Berlin, Germany, 331 pages, illustrated. Price DM 36.

Germanium Diodes. By Dr. S. D. Boon. Published by Philips Technical Library. Distributed by Elsevier Press, Inc, 2330 Holcombe Blvd, Houston 25, Texas. 87 pages, illustrated. Price $1.95.

Legal Problems in Engineering. By Melvin Nord. Published by John Wiley & Sons, Inc, 440 Fourth Ave, New York 16, N. Y. 391 pages, Price $7.50.

ASTM Standards on Textile Materials. Prepared by ASTM Committee D-13 on Textile Materials. 1916 Race Street, Philadelphia 3, Pa. 788 pages, Price $5.75.

Atomic Theory Made Easy

Electrons, Atoms, Metals and Alloys—2nd Edition. By W. Hume-Rothery. Published by Philosophical Library, Inc, 11 East 40th Street, New York 16, N. Y. 387 pages, illustrated. Price $10.00.

A non-mathematical treatment of the application of electron theory to the structure and properties of metals and alloys, this book presents a dialogue between an older metallurgist and a young scientist. The scientist explains the new theories that have been formulated since the metallurgist's school days (1920 or later). This presentation makes the subject more palatable and the book is an excellent elementary introduction to modern atomic theory.

Essentially the author tells what the new theories are about, rather than what they are. This revised edition carries new material on plastic deformation and a new section on nuclear structure. It is divided into four parts: nature of the atom, of a metal, of an alloy, and structure of a nucleus. The theories of such physicists as Bohr, Heisenberg, Pauli, Planck, and Schrodinger are presented.

For the utility engineer this will have little direct value to him in his everyday work. But the engineer who would like to keep abreast with the science but has neither time or inclination to read detailed treatises will find this an excellent book.

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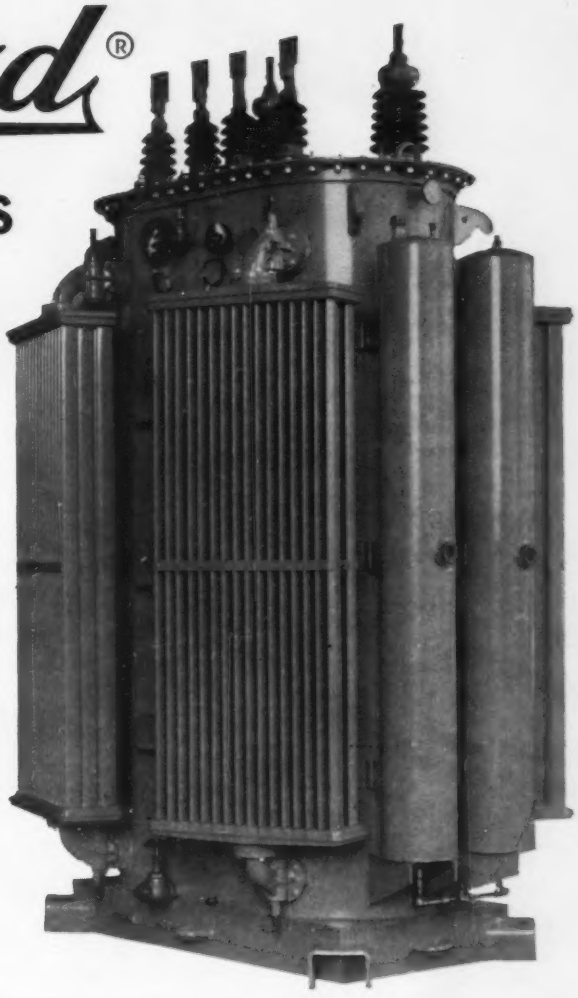
efficient . . .
economical . . .
dependable



2500 KVA, single-phase, OISC power transformer, 34,500 volts primary, 2400x4800 volts secondary. Special design to meet customer's specifications. Standard engineers will work with you to meet your requirements.

● Where power requirements demand above-average reliability and efficiency, Standard Power Transformers are your one best choice. Figures taken from service records show how Standard's sound engineering principles cut maintenance costs to the bone and boost transformer life.

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We can build transformers to your specifications as quickly and economically as if you'd bought repetitive designs.

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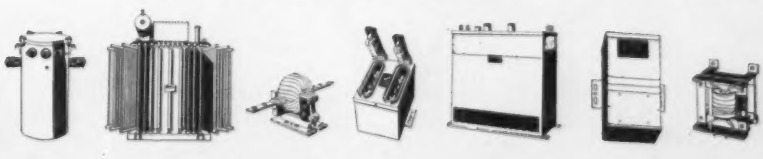
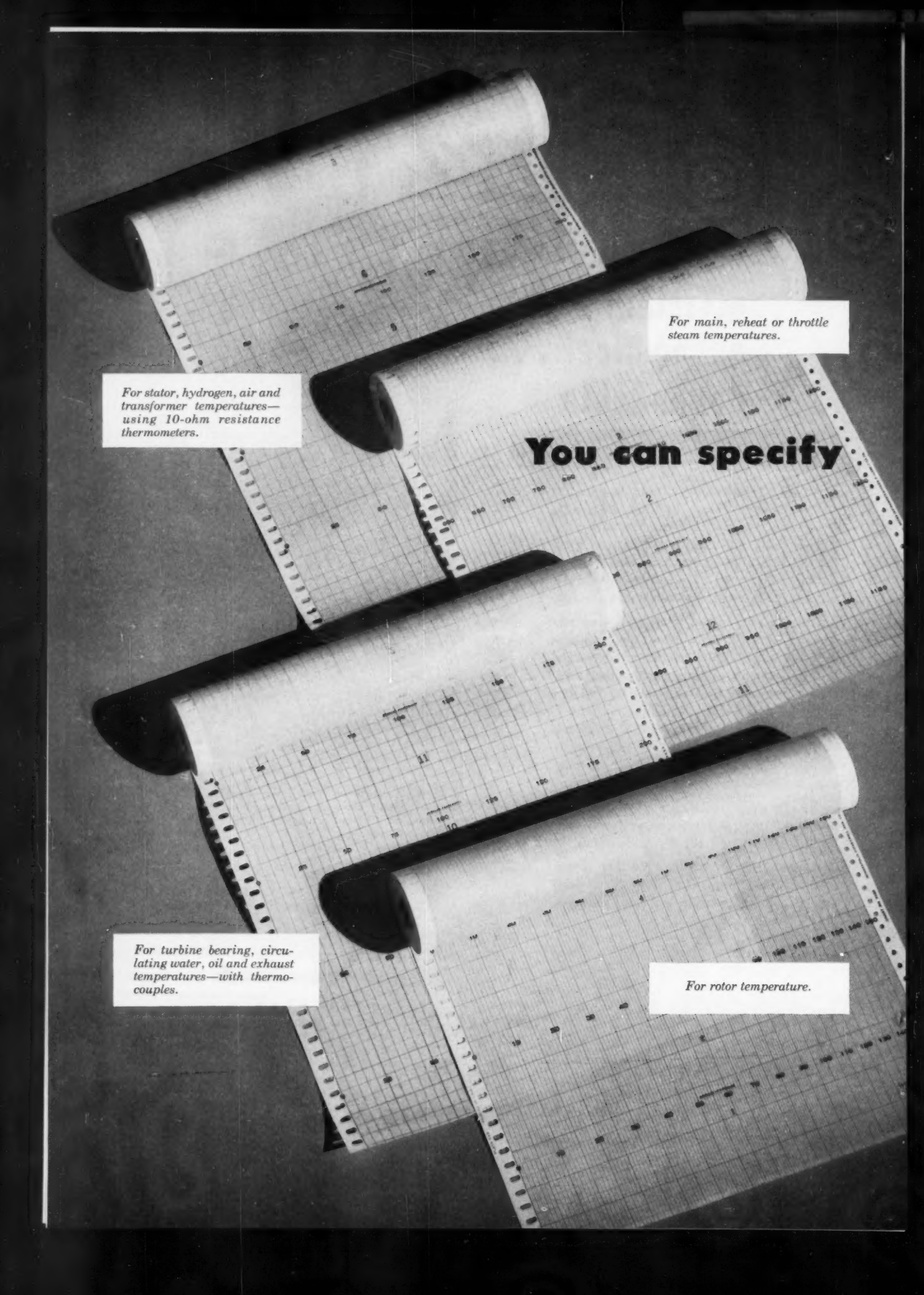
FOR EVERY APPLICATION

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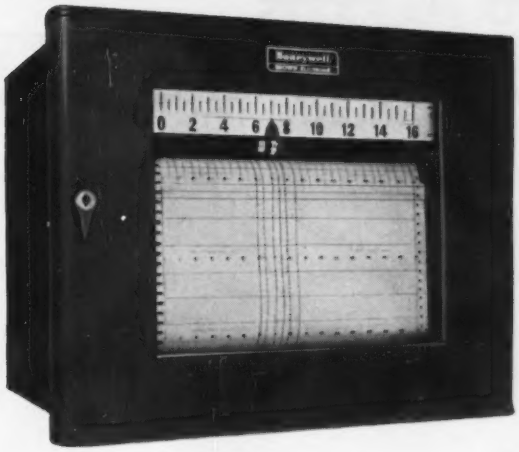
For main, reheat or throttle steam temperatures.
For stator, hydrogen, air and transformer temperatures—using 10-ohm resistance thermometers.
For turbine bearing, circulating water, oil and exhaust temperatures—with thermocouples.
For rotor temperature.



ElectroniK strip chart recorders can be supplied for power plant use with scores of different temperature calibrations. Some of the typical standard charts are shown on the opposite page. Actual chart size is 11 inches in calibrated width.

an *ElectroniK* recorder ... for any of your temperature measurements

GENERATOR stators and rotors, coolers, transformers, bearings, oil . . . steam headers, reheat steam, throttle steam . . . all require precise and reliable temperature measurement.

The accurate, efficient way to keep constant watch over any or all of these is to use *ElectroniK* recorders. A broad variety of standard calibrations is available to work with thermocouples, standard 10-ohm copper resistance thermometers; or, for rotor temperatures, with the individual rotor winding. Numerous ranges cover all the temperatures encountered in modern power plant practice.

You can select models which record a single temperature, or which combine from two to twenty related temperatures on a single chart for simplified correlation. On the 11-inch wide charts, operators can spot trends in accurate detail . . . engineers can analyze operation readily. Daily chart sections are easily removed for filing. Instruments can be supplied with built-in circuits to actuate signals and annunciators to warn of excess temperatures. And to work with these recorders, Honeywell supplies a comprehensive line of thermocouples, extension wires and resistance thermometer elements designed for power plant applications.

ElectroniK instruments are famous for their ability to stay on the job with minimum attention. This characteristic has been proved in thousands of industrial installations, including many of the country's leading power plants. For a discussion of how they can be applied to your plant temperature measurements, call your local Honeywell sales engineer . . . he's as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, Wayne and Windrim Avenues, Philadelphia 44, Pa. — in Canada, Toronto 17, Ontario.

● **REFERENCE DATA: Write for Bulletin 9070, "Instruments for Electrical Power Generation."**

MINNEAPOLIS
Honeywell
BROWN INSTRUMENTS
First in Controls

GE Unveils Highly Mechanized Motor Plant

General Electric Co recently unveiled a modern electric motor plant featuring highly mechanized production lines. The new Schenectady facility can turn out standard squirrel cage motors in 24 hr, compared to 3 weeks previously.

James M. Crawford, vice president of the company's Motor and Generator Division, explained that "for the first time, electric induction motors in the 7.5 to 30-hp range are being produced on a mass production basis."

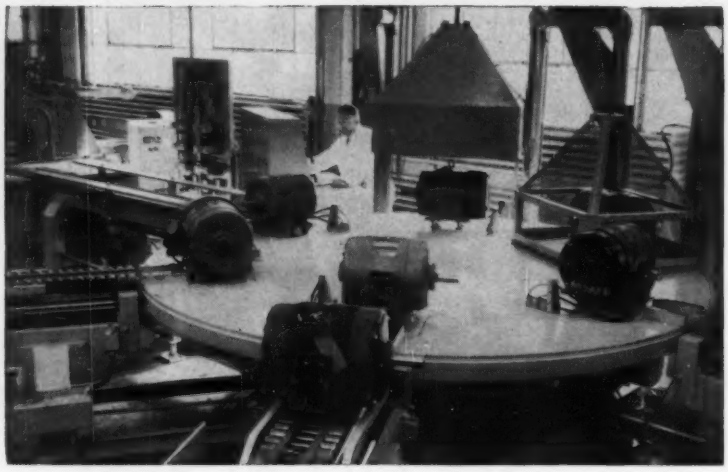
The new plant was designed to meet a rapidly expanding total motor market which is expected to be at least 75% higher by 1965, Crawford continued. It was built at a cost of about $7 million, has a manufacturing area of 168,000 sq ft, and has approximately 600 employees.

The new plant is operated by the Medium Induction Motor Department, Motor and Generator Division. It makes extensive use of push button controls to machine, assemble, and test G-E Tri-Clad "55" induction motors. These new operating controls have enabled the department to reduce to two the number of major hand operations involved in the manufacture of standard motors. The hand operations still in use involve stator winding and a portion of final motor assembly.

O. F. Vea, general manager of the department, said, "Despite this reduction in major hand operations, we are now employing more personnel than ever before."

Actually the new plant is three factories under one roof. Standard models of motors in frame 250 are manufactured in a straight-line flow on the left assembly line, in frames 280 and 320 in right assembly line. Special motors are produced in a middle line. This line draws standard components from the other two lines, thus expediting its production of "specials" which still remain, basically, hand-produced motors.

Methods adapted have cut production time on standard induction motors from three work weeks to three 8-hr shifts. The department manufactures about 100 standard models plus a wide variety of special motors.



Motor parts travel toward final assembly and testing along roller-type conveyors, with an overhead suspension system employed as needed for the handling of materials and for such operations as moving the wound stators through an automatic dip and bake.

Streamlined materials handling has sharply increased the flow and production of the motors. Flexibility has been enhanced by placing all machines except the largest punch presses on movable mounts.

The many testing operations demonstrate the emphasis placed on quality control. All motors are tested automatically on a circular platform (see illustration) at the end of each standard line. Designed to handle six motors at a time, the platform is rotated to perform tests on a total three-minute cycle for such factors as vibration, noise, electrical resistance, high voltage reaction.

As they leave the final test platform the motors are crated and raised by an automatic lift into a slotted storage bank—similar to self-filling slots in some food markets.

Accommodating more than 1,000 boxed motors at one time, the bank receives the motors at one end, and sloped roller conveyors move each box forward as the boxes ahead are removed.

Westinghouse to Build Switchgear Plant

A multi-million-dollar plant for the manufacture of switchgear distribution apparatus will be built on a 148-acre site near Bloomington, Ind., by Westinghouse Electric Corp. The announcement was made on Apr. 25 by A. C. Monteith, Westinghouse vice president in charge of apparatus products.

Products to be made at the 277,000-sq ft plant include capacitors and lightning arresters for electric utility transmission systems, cutouts and oil-type reclosers for use on medium voltage distribution systems.

It is expected, Monteith said, that the production changeover from the distribution apparatus department now located in the East Pittsburgh plant to the new location will begin in late 1957. Construction on the new building is scheduled to begin late in 1956.

At the same time, it was also announced that F. F. Herman has been named manager of the new plant.

(*More M & M on page* 150)

Jersey Central Power & Light's New 115-kv Line

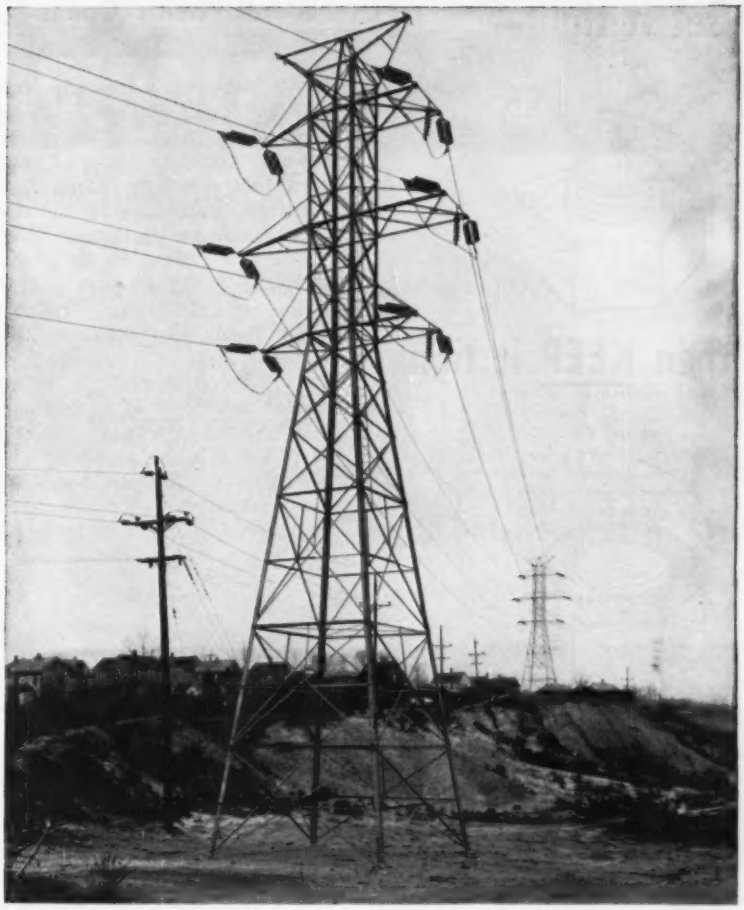
Steel transmission towers used in connecting Sayreville plant with Larrabee substation

Increased power requirements in and around Lakewood led Jersey Central Power and Light Company to begin construction of a 115-kv transmission line in 1955. Planned to be put into service in 1956, the line starts at the Sayreville steam-electric generating station at Sayreville, near Perth Amboy. Its terminus is the Larrabee substation just north of Lakewood and about 12 miles southwest of the company's headquarters in Asbury Park.

The critical portions at both ends of the line utilize steel towers, designed and fabricated by Bethlehem. Of the forty-seven towers used, twenty-nine are of the double-circuit suspension type, 99 ft in height. Fourteen are 114-ft double-circuit towers, and four others, used to span a highway and double-track electrified railroad, are of single-circuit design. The steel towers, averaging about 750 ft in span length, account for 6½ miles of the Sayreville to Larrabee line.

FOUNDATION PROBLEMS . . . Unstable subsoil created some difficult problems in anchoring a number of the towers. These are located on New Jersey mud flats where only five or six feet of fill covers many feet of soupy mud. Timber piles, 60 to 70 ft long, were used – as many as twelve under each footing.

Overhead the towers carry 795,000-cm ACSR conductors and 3 #6 Copperweld ground wires.



The line is shown here skirting a residential section of Sayreville. The 60-deg tower in the foreground, 114 ft high, is located in one of the clay pits which supplies the Sayreville brick-making industry.

FABRICATED AT LEETSDALE . . . The 47 steel towers were detailed, fabricated and galvanized at our fabricating works in Leetsdale, Pa., near Pittsburgh.

Other Bethlehem tower shops are located at South San Francisco, Calif., and Seattle, Wash. These shops on the Pacific Coast, together with the facilities in the East at Leetsdale, are well equipped to handle any requirements in the design and fabrication of transmission towers and switching structures. For complete information please call or write the Bethlehem sales office most convenient to you.

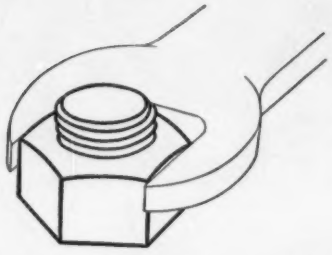
One of the two pairs of 90-ft single-circuit towers that support the line as it spans the tracks of the electrified Camden-Amboy Division of the Pennsylvania Railroad, as well as a heavily-traveled highway.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

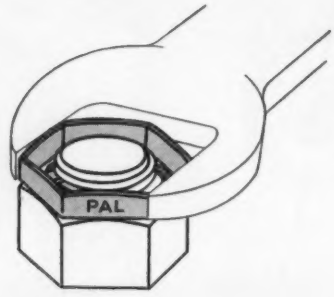
On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

Get it tight—



then KEEP it tight



with a

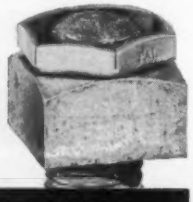
PALNUT LOCK NUT

JUST spin on a PALNUT Lock Nut and lock with 1/3 turn of a wrench. Takes but seconds, cost is negligible, protects for the life of the installation. PALNUT Lock Nuts exert a double locking action that prevents the plain nut from loosening and the bolt from backing out, under severest vibration. Eliminates further checking or re-tightening on mechanical assemblies —maintains perfect conductivity on electrical connections.

Widely Used Thruout Utility Field

PALNUT Lock Nuts have been used for years on wood poles, steel towers, fittings, connectors, switches, hardware, transformers, etc. Complete range of sizes, in all finishes and materials used by utility industry. Get Bulletin #577.

THE PALNUT COMPANY
51 Glen Road
Mountainside, N. J.



PALNUT
TRADE MARK
LOCK NUTS
for quick, secure fastening at low cost

Federal Pacific Opens New Dallas, Tex., Plant

New plant facilities that will permit doubling output and service for distributors in Texas, Oklahoma and western Louisiana were formally opened this month by Federal Pacific Electric Co, according to Robert C. Graves, vice president-sales.

The new Federal Pacific plant is located at 901 Regal Row in the Brook Hollow industrial district. Situated on a 5-acre plot, the facilities provide a total of 46,000 sq ft. Areas are distributed approximately as follows: Production, 31,000 sq ft; warehouse, 10,500 sq ft; and offices 4,700 sq ft. D. H. Ladd is plant manager.

The Dallas plant will specialize in the manufacture and distribution of switchboards, panelboards, motor control centers, unit substations and related products.

Sylvania to Expand in Nuclear Power Field

A multi-million dollar expansion program in the atomic power field was announced recently by Sylvania Electric Products, Inc.

Don G. Mitchell, Sylvania chairman and president, said that the first step of the program, which will extend over the next five years, will be new production and development facilities for nuclear fuels and components. The new production plant and laboratory will be constructed on one of several sites under consideration in the East, Mitchell said. He declined to be specific as to possible location.

The new production and engineering facility, entirely owned by Sylvania, will be completed by late 1957, according to Walter E. Kingston, general manager of the company's Atomic Energy Division.

Included in the over-all expansion program is the eventual establishment of a complete "out-of-pile" fuel service for nuclear reactors, Kingston said.

Patent Exhibit Displayed to A-C Employees

Allis-Chalmers Mfg Co has arranged for a patent exhibit to be viewed at the company's various plants. Purpose of the traveling exhibit is to show employees the importance of patent service and to stimulate creative thinking.

A five-day display was held recently at the company's Pittsburgh Works. Here patents of 13 of the Pittsburgh employees were represented on display boards. These boards were set up opposite the standard patent exhibit which covers a range of company products.

MANUFACTURERS' EARNINGS

COMPANY	MONTHS	ENDING	NET INCOME 1955	NET INCOME 1954	EARNINGS PER COMMON SHARE 1955	EARNINGS PER COMMON SHARE 1954
American Chain & Cable Co.	12	Dec 31	$6,079,199	$3,473,774	$5.75	$3.28
Anaconda Co.	12	Dec 31	65,256,306(t)	26,653,085	7.52	3.07
Babcock & Wilcox Co.	12	Dec 31	13,486,717	15,211,990	8.26	9.31(a)
Blaw-Knox Co.	12	Dec 31	2,444,197	4,124,137	1.56	2.63(c)
Combustion Engineering, Inc.	12	Dec 31	5,624,741	6,611,408	5.33	6.27(a)
Gulf Oil Corp.	12	Dec 31	218,063,510	182,813,045	8.19	6.87(c)
Holophane Co.	6	Dec 31	597,976	488,713	1.58	1.29
Harvey Hubbell, Inc.	12	Dec 31	1,555,681	1,177,674	4.86	3.68
Ingersoll-Rand Co.	12	Dec 31	27,496,417	23,038,857	4.54	3.80
Minnesota Mng & Mfg Co.	12	Dec 31	34,323,370	24,241,885	4.14	2.95(c)
I-T-E Circuit Breaker Co.	12	Dec 31	1,758,325	1,748,715	1.48	1.54(c)
H. K. Porter Company, Inc.	12	Dec 31	6,433,107	3,215,785	6.15	3.06(a)
Revere Copper & Brass.	12	Dec 31	11,281,984(k)	10,276,994(m)	8.70	7.98
Sprague Electric.	12	Dec 31	3,003,128	3,333,408	2.42	2.68
Square D Co.	12	Dec 31	8,386,064	5,683,734	4.95(a)	3.35(a)
U. S. Hoffman Machinery.	12	Dec 31	2,302,134(r)	632,905	2.61(b)	0.67(a)
U. S. Steel.	12	Dec 31	370,099,353	195,417,611	6.44	3.23

(a) Based on shares outstanding at close of period. (b) Based on average number of shares outstanding during the period. (c) Based on shares now outstanding. (k) Includes $457,336 insurance recovery on hurricane losses in 1954. (m) After provision of $1,455,516 for hurricane losses. (r) After adjustments for devaluation of the Argentine peso and reserve for possible renegotiation. (s) After adjusting for three-for-one stock split in May, 1955. (t) After deducting $15,927,784 flood damages at the Connecticut mills of the American Brass Co.

Instrument Transformer Line Being Redesigned

Standard Transformer Co, Warren, Ohio, is developing and testing a completely redesigned line of current, metering and potential transformers.

The company reports that the units will meet NEMA, ASA and EEI specifications. Dimensions will permit the transformers to be interchangeable with types offered by other manufacturers.

U. S. Aluminum Production

Primary aluminum production in the United States was 145,937 tons in March, according to the Aluminum Association, New York. This amount is a record month production. It is an increase of 13,175 tons from February, and an increase of almost 15,700 tons over March, 1955. Total production for this year through March amounted to 419,098 tons. This is a record quarter, and an increase of almost 44,400 tons over the same 1955 period.

U. S. Copper Production

U. S. production of primary copper was 100,272 tons in March, according to the Copper Institute, New York. It is more than 10,940 tons over February and almost 760 tons over October, 1955, the highest for that year. Refined copper production amounted to 144,027 tons in March, an increase of 16,110 tons over February. Deliveries to fabricators were 141,590 tons in March, compared to 139,383 tons in February. Refined stocks at the end of March totaled 51,595 tons, up from 47,053 tons at the end of February.

Univac for Con Edison

Some customers of Consolidated Edison Co of New York can expect to receive early this summer the first bills turned out by the utility's Univac system. Con Edison has installed two Sperry-Rand Univac systems for customer accounting and an IBM 705 system for payroll and general accounting.

BIDDLE *Instrument News*

Biddle Dielectric Test Set **Model 1-40 KV**

—for measuring d-c current at voltages up to 40 kv when applied to the insulation of such equipment as generators, transformers, bushings and cable.

Special hand truck supplied as an accessory for this equipment. This truck permits one man to handle the set safely and without difficulty, on stairways as readily as on the straightaway.

This portable field instrument has been developed in response to the growing use of and demand for higher d-c test voltages.

Carefully considered safety features, excellent output voltage regulation, simple operation, compact design, and facilities for making voltage and current measurements at either polarity have been incorporated in this test set. Years of Biddle engineering experience in insulation testing are reflected in this equipment which has already proven its reliability and performance in field use.

The set has a current rating of 25 milliamperes at short circuit, and current measurements can be made down to 0.5 microamperes which is the first division on the microammeter.

Over-all dimensions are: height 19½ in., width 13½ in., depth 20 in., weight 120 lbs. All high voltage components are oil immersed.

For complete details, description, specifications, and prices, write for **Bulletin 22-W.**

James G. Biddle Co.
1316 Arch St., Phila. 7, Pa.

Gentlemen: Please send me **Bulletin 22-W**

NAME

JOB FUNCTION

COMPANY

ADDRESS 8608

JAMES G. BIDDLE CO.

- ELECTRICAL TESTING INSTRUMENTS
- SPEED MEASURING INSTRUMENTS
- LABORATORY & SCIENTIFIC EQUIPMENT

1316 ARCH STREET
PHILADELPHIA 7, PA.

NEWS ABOUT PEOPLE

NIPSCO Elects Rees, Kussmaul Vice Presidents

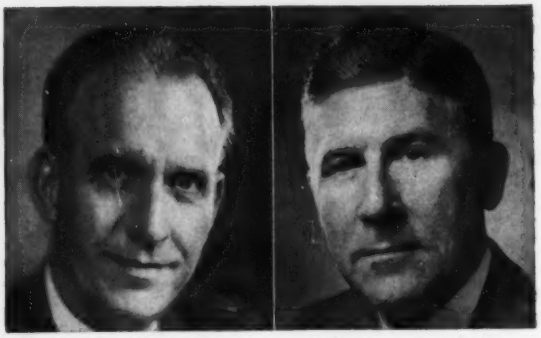
Northern Indiana Public Service Co has announced the promotion of Carl D. Rees and Walter H. Kussmaul to two newly created vice presidential positions.

Rees, who has more than 25 years service with the company, becomes vice president with responsibility for a number of activities including contacts with community officials in the cities and towns in which NIPSCO operates.

A veteran of 33 years with the company, Kussmaul advances from general operating superintendent to vice president in charge of operations.

After obtaining his civil engineering degree from Ohio University, Rees joined NIPSCO in 1929 as a cadet engineer, and three years later became superintendent of distribution in the Michigan City district. He was named Valparaiso district manager in 1934, a post he held until 1945 when he was promoted to Dunes Division manager. His appointment as Calumet Division manager in 1950 was followed by his promotion two years later to executive assistant to the executive vice president.

Kussmaul, a Bliss Engineering School of Maryland graduate, joined Calumet Gas & Electric Co, a predecessor of NIPSCO, in 1923. Six years later he was named NIPSCO general storekeeper, and in 1936 became industrial relations manager of the company. In 1949 he was appointed assistant general operating superintendent, and seven months later he became general operating superintendent.



CARL D. REES WALTER H. KUSSMAUL

Lerch, Math Named VP's by Iowa-Illinois G&E

Iowa-Illinois Gas & Electric Co has announced the appointments of Ed Lerch and C. J. Math as vice presidents of the company.

Lerch, formerly vice president in charge of districts and sales, becomes vice president and consulting engineer and has been re-elected a member of the company's board of directors.

Math, who has served as an assistant vice president of the company since April, 1954, assumes Lerch's former position of vice president in charge of districts and sales.

ED LERCH C. J. MATH

Philco Ups Skinner to President

James M. Skinner, Jr, vice president and general manager of Philco Corp's Television Division since last year, has been elected president of the company. He replaces James H. Carmine who continues as an active member of the board of directors and finance committee. He will also serve as a special consultant on sales and merchandising.

Since joining Philco in 1934 Skinner has held executive positions in numerous company divisions, including sales manager and later general manager of the Accessory Division, vice president of sales for the Refrigeration Division, and vice president of distribution to coordinate all sales activities of Philco divisions.

JAMES M. SKINNER, JR

FEEDING anode on Anaconda Type CP Cable into manhole to protect lead-covered cable.

Why let corrosion steal your investment in metals —when protection costs so little

Utilities that have tried cathodic protection call it the best insurance they have. Savings often run into thousands of dollars a year with the protection of:

- metallic-covered cable
- metallic ducts
- buried metallic structures in generating plants, substations, etc.

To handle this special job, Anaconda has developed a special Type CP Cable. Jacket of polyethylene and Densheath* (PVC) insulation offer top resistance to moisture and soil acids . . . double protection affords longer cable life. For buried or aerial distribution lines feeding power to CP systems, use Anaconda's neoprene-jacketed Durasheath* Cable.

For more information on how Cathodic Protection checks corrosion, and detailed information on Anaconda Type CP Cable, write for Bulletin DM-5450. Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y.

*Reg. U.S. Pat. Off. 56358

SPECIAL CONDITIONS in cathodic protection demand a special cable. Anaconda's Type CP Cable withstands moisture, acids and alkalies in the soil—cuts replacement costs.

SEE THE MAN FROM **ANACONDA®**
FOR **CATHODIC PROTECTION CABLE**

Wagner Electric Promotes Evans, Holtzman

J. C. EVANS

Newly elected officers of Wagner Electric Corp are J. C. Evans, controller, and E. G. Holtzman, secretary-treasurer. J. P. Harbacek, formerly general credit manager, becomes assistant secretary and assistant treasurer.

Evans has held various sales and administrative positions since joining Wagner in 1935, and was named assistant controller in 1952. In his new post he succeeds F. F. Simon who remains with the company on a consulting basis.

Holtzman has been with Wagner since 1942 and has served as assistant secretary and assistant treasurer for the past three years. As secretary-treasurer he replaces J. D. Eby who remains as a consultant.

E. G. HOLTZMAN

Rea Will Cover Southeast from Atlanta

David Rea, for the past year Southeastern editor of Electrical World, has established headquarters at Atlanta, Ga. The new office, Room 801 in the Rhodes-Haverty Building, is the fourth field office in EW's network.

Rea, who received an electrical engineering degree from the University of Washington in 1948, joined the staff in 1952 as an assistant editor. Two years later he was named Northeastern editor. He came to EW after serving in the U. S. Signal Corps at Fort Monmouth, N. J. Previously he had been a distribution engineer with Seattle City Light and had worked for a motor servicing company at Tacoma, Wash.

DAVID REA

PERSONAL BRIEFS

Minnesota Power & Light Co has announced the promotions of four men to executive positions. They are **Philip V. Colburn,** Cloquet Division manager, who becomes Duluth Division manager to succeed retiring **E. A. Kefgen; Alvin J. Probst,** Chisholm district manager, now advanced to Cloquet Division manager; **Sylvester Laskin,** purchasing agent, who becomes Range Division manager to replace **William Luthjohn** who retired; and **Arthur C. Smythe,** Duluth Division sales manager, who becomes purchasing agent.

Lamont J. Brundige has been appointed to succeed the late **William R. Bowler** as manager of Pacific Gas & Electric Co's San Jose Division. **Richard L. Hayden,** manager of customer and community services, assumes Brundige's former post of Sacramento Division manager.

Paul P. Ashworth, executive vice president and chief engineer of Telluride Power Co, has transferred from Richfield to Salt Lake City to work more closely with Pres **H. R. Waldo** and **O. C. McShane,** Richfield general manager, will assume some of the duties formerly charged to Ashworth.

Pacific Power & Light Co has designated **Don Frisbee** as an assistant treasurer in charge of its new $1-million electronic accounting system.

Dr. Ralph D. Bennett, former manager of Knolls Atomic Power Laboratory's technical department, has been appointed manager of General Electric Co's Vellecitos, Atomic Laboratory, Pleasanton, Calif., which will begin operation in 1957.

John R. Lenox, director of Minneapolis-Honeywell Regulator Co's Ordnance and Transistor Divisions, has been promoted to general manager of the Appliance Controls Division, Gardena, Calif. He is succeeded by **Clyde A. Parton,** previously director of engineering, Aeronautical Division. New factory manager for the California plant is **Raymond S. Fries.**

Aluminum Company of America has named **J. T. Barclay** fabricating works manager of its Vancouver operations, replacing **E. D. Mairs** who becomes manager of Alco's Lafayette works.

OBITUARY

Dr. Harvey L. Curtis, 81, for many years chief of the inductance and capacitance section, electricity division of the National Bureau of Standards, and noted for his work in absolute electrical measurements, died recently.

Sterling M. Gardner, 70, founder of Gardner Electric Manufacturing Co, now the Gardner Transformer Division of Federal Pacific Electric Co, died recently of a heart attack.

Hugh H. Lenhart, 58, chairman of the board of Cheyenne Light, Fuel, and Power Co since 1955, died recently of a heart attack. He was formerly vice president and general manager.

Sell running water to increase power loads

Every installation of a Fairbanks-Morse electric water system opens the way for the sale of *more power*.

Families with new water systems almost immediately begin buying load-building appliances including electric refrigerators, water heaters for the milkhouse and home . . . electric stock water fountains . . . washers . . . driers . . . ironers . . . milk coolers . . . pipe thawers . . . dishwashers . . . and garbage disposers.

We have a cooperative plan

Homes and farms which do not have electric water systems are *prime sales targets* for power producers and Fairbanks-Morse. Our field-tested educational program can help us both. It includes panel displays, wall charts and literature that get prospects interested in buying an electric water system and other appliances. This material is used with telling effect in window and store displays, at meetings and country fairs. For details, mail the coupon today.

FAIRBANKS-MORSE

a name worth remembering when you want the BEST

WATER SYSTEMS • GENERATING SETS • MOWERS • MAGNETOS
PUMPS • MOTORS • SCALES • DIESEL LOCOMOTIVES AND ENGINES

Fairbanks, Morse & Co., Dept. EW-4-30
600 S. Michigan Ave., Chicago 5, Ill.

Gentlemen:
Please tell us how we can avail ourselves of Fairbanks-Morse's promotional material to help increase our power load.

Company name.....

Your name.....

Address.....

City.....State.....

NEW!

ALCOA No. 2 ELECTRICAL JOINT COMPOUND
DIRECTIONS FOR MAKING JOINTS
1. Remove grease and dirt from contact surfaces.
2. Apply compound liberally.
3. For maximum results, abrade surfaces through coating with wire brush or emery cloth.
4. Assemble joint without removal of compound.
ALCOA
ALUMINUM
ALUMINUM COMPANY OF AMERICA
8 FL. OZ. — WHEN FILLED

HANDILY PACKAGED IN CONVENIENT PLASTIC SQUEEZE BOTTLE

Bottle is delivered sealed. To use, pull off cap and nip off tip of spout. Then use and recap like household oil can.

AVAILABLE IN BULK—For those who use the brush pot method, Alcoa #2 EJC is shipped in 25-pound sealed pails or one-pint cans.

ALCOA Electrical Joint Compound

Chemically removes oxide film from aluminum or copper without any action on base metal . . .

MAKES AND MAINTAINS REALLY LOW-RESISTANCE JOINTS

Alcoa® #2 Electrical Joint Compound, or #2 EJC, actually works chemically to dissolve the oxide film on aluminum or copper conductors and fittings. And it removes the oxide without any corrosive effect on the metal itself. After the joint is made, #2 EJC, insoluble in water, remains to seal, protect and prevent re-forming of the oxide.

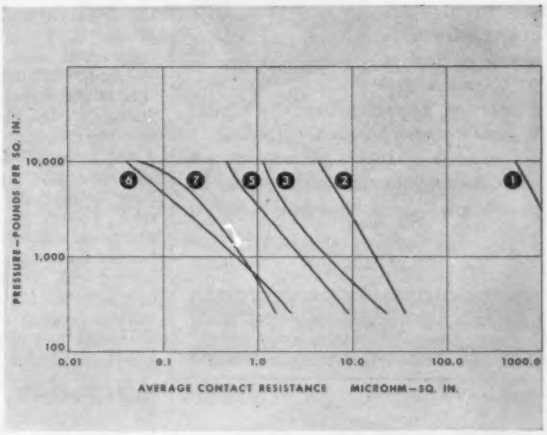
In comparative pressure-resistance tests on different methods of preparing electrical joints, #2 EJC makes joints that are in the same range as silver plating. In the log-chart at the right, using stacks of ¼-in. x 1-in. aluminum bus bars, the curves are as follows: (1) no treatment; (2) a metal dust in grease; (3) an inhibitor, abraded; (5) Alcoa #2 EJC, no abrasion; (6) Alcoa #2 EJC, abraded with emery; (7) silver-plated bus. Each resistance was measured across 10 interface contacts.

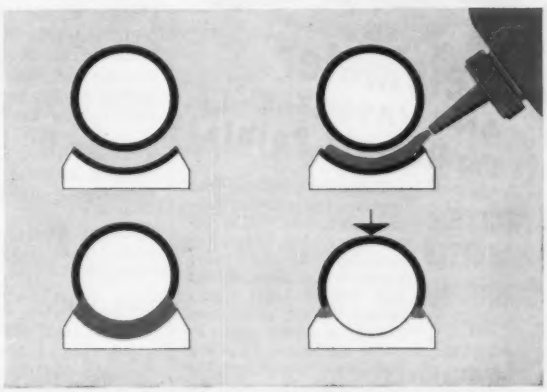
With #2 EJC, connections can be made with aluminum to aluminum, or aluminum to copper, in the extremely low-resistance range of silver-plated conductor. With #2 EJC, joints of a truly low electrical resistance can be made easily and at the lowest cost of any method.

Your men will really like the handy, convenient method of packaging, too. The flexible squeeze bottle is oval shaped to prevent rolling . . . holds 8 fluid oz. and is pocket sized. It is designed for easy, one-hand operation and will prevent waste.

Alcoa #2 EJC, with its squeeze bottle, is another product of the Alcoa Research and Development Laboratories. In these laboratories, continual research in better conductors and accessories is resulting in better and more economical ways to conduct electricity.

Alcoa #2 Electrical Joint Compound is now available in cartons of 12 squeeze bottles, each containing 8 fluid oz. It is also available, for bulk users, in 25-pound sealed pails or one-pint cans. For further information on this new development for low-resistance joints, contact your local Alcoa sales office, or write 2306-DD Alcoa Bldg., Pittsburgh 19, Pa.





HERE'S HOW IT WORKS—as shown in the schematic sketches above, Alcoa #2 EJC actually dissolves the oxide film, assuring a metal-to-metal joint of really low electrical resistance . . . also seals, protects and prevents re-forming of the oxide.

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Telemeter transmitter converts DC mv from thermal converters, etc. to 10-30 cps which frequency modulates an audio tone channel. Receiver detects and demodulates transmitted signal, generating a DC mv for operation of recorders or indicating instruments. Up to 45 telemeters can be multiplexed. Any communication link, including power line carrier, may be used. Overall accuracy is 1% with a response speed of 1 sec.

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SALES ASSIGNMENTS

COMPANY STAFFS

Allis-Chalmers Manufacturing Co's Industries Group has named A. P. Bowman manager of its Rockford, Ill., district office and Dean K. Steidinger as Jackson, Mich, district manager. Steidinger succeeds Lathrop F. Berry.

Four Wheel Drive Auto Co's new district sales manager for South Texas is Douglas E. Reed. Hunter O. Wagner, Sr, has been assigned to Arkansas, Alabama, Louisiana, Mississippi, and western Tennessee in the same capacity.

General Electric Co has appointed Simon J. Tombaugh east central district manager of the Apparatus Sales Division's User Industries Sales Department to succeed Edwin H. Howell, recently elected a commercial vice president. Replacing Tombaugh as User Industries Sales manager in the Indianapolis area is John T. Stone . . . GE plans establishment of its new Northeastern Sales District on May 1 with Robert E. Jordan as manager. He will have sales responsibility for Maine, New Hampshire, Vermont, Massachusetts, Connecticut, Rhode Island, and north and central New York State. Named as manager of the eastern sales district with headquarters in New York City is Robert E. Hixson, who will handle the metropolitan New York, New Jersey, Delaware, and eastern Pennsylvania and Maryland area.

Graybar Electric Co, Inc, has announced the following managerial appointments: R. K. Charles, operating manager for the Denver location; D. B. Eardley, manager, Salt Lake City area; E. L. Drummond, manager at Beaumont; G. D. Johns, manager at Baton Rouge; and W. L. Johnson, manager of inside construction sales at New York.

Reliable Electric Co has designated R. R. Meinert as sales representative for the Minneapolis district.

Southern States Equipment Corp has named S. D. Sautel assistant to the sales manager.

Square D Co has advanced William Younger and William Moriarty to the newly created positions of eastern sales manager and distributor sales specialist, respectively . . . George Helbock is new Denver district manager serving Square D's Intermountain area.

Westinghouse Electric Corp's Lamp Division has named Harold G. Barnwell, Jr., as operations manager of the southeastern region with headquarters in Chamblee, Ga. Curtiss C. Harbin is new assistant to the southeastern region sales manager for the Lamp Division.

REPRESENTATIVES

General Electric Co's Carbolay Department recently appointed Central Supply Co of Virginia, Inc, an authorized Carbolay carbide mining tool distributor.

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your
man!

ELECTRICAL WORLD's audience is everyone concerned with generation, transmission, distribution and utilization of electricity in large amounts— 25,000 *all-paid* subscribers! In utilities and big industry, among electrical manufacturers and consultants . . . only World covers the entire Electric Power Industry. Like to know more, in easy dosage? Write for "Quick Facts" . . . Electrical World, 330 West 42nd St., New York 36, N. Y.

THE SHORTAGE OF SCIENTISTS AND ENGINEERS:

How Critical Is It?

The United States is running into a serious shortage of scientists and engineers. There is no novelty in this observation. It has often been made in the last few years. And there has been mounting alarm about what this shortage may mean for both our national security and our prosperity.

There would be great novelty, however, if general agreement were attained on such important matters as the size of the shortage, the extent of the damage it threatens to inflict, and the best ways to eliminate it. The purpose of these editorials is not to provide this novelty, but to ventilate some of the key aspects of the shortage of scientists and engineers.

This first editorial in the series is designed to throw light on the over-all dimensions of the shortage. Others to follow will be addressed to such questions as:

- How serious is the threat to our economic well-being and to our national security?
- What needs to be done to prevent the shortage from becoming critical?

Rise Has Been Rapid

The problem is *not* that we have been producing a small number of engineers and scientists. Indeed, the number has risen sharply. We now have a working force of more than 600,000 engineers, over twice as many as the 286,000 there were in 1940. And we have about 250,000 scientists (chemists, physicists, biologists, geologists, mathematicians, etc.), compared to only 92,000 in 1940. About one in 148 persons in the labor force of 1940 was a scientist or engineer; today the ratio is about one in every 80.

In research and development work, where highly creative scientific minds are required, there has been fully as rapid a rise in employment of scientists and engineers. Fewer than 90,000 were employed in research and development fifteen years ago; the total now exceeds 200,000.

—But Not Rapid Enough

Despite this rapid increase in the number of scientists and engineers—at a rate much faster than the increase in the labor force as a whole—the needs of industry, government and education for technically trained people have risen even more sharply.

The principal reason for this mounting demand is the prodigious growth of research in the last 15 years. From a total of only about $900 million spent on all types of research in 1941, the annual expenditure rose to over $5 billion by 1953 (the latest estimate available). Over two-thirds of the research is done by private industry, mostly to develop new and better products and to find new and better methods of production. Most of the rest is performed by the government, largely to develop improved and inevitably more complex scientific weapons.

One aircraft company has found from its own experience that it required 17,000 engineering manhours to develop a typical fighter plane in 1940. The requirement is now about 1.4 million engineering manhours. Development of the typical fighter plane of 1960 will require well over 2 million engineering manhours.

In this dramatic example, the need for engineering services for a basic piece of military equipment soared 80 times in 15 years. It is an indication of why the demand for more and more technically trained men and women has outstripped even the imposing increase in scientific and engineering manpower of the last decade and a half.

Size of the Gap

Exactly how great the gap is between the available supply of scientists and engineers and the number required, it is impossible to say. In some instances technical talent undoubtedly could be better used than it is now. And part of the shortage might "disappear" if higher salaries had to be paid. (These questions will be discussed in later editorials.) But informed estimates of the approximate size of the gap can be given.

- According to the best available information, from estimates by the Engineers' Joint Council and the U. S. Bureau of Labor Statistics, **the minimum need for engineers from graduating classes is 40,000 each year for the next ten years.** Last year we graduated only 23,000 engineers, just about enough to cover replacement needs without allowing for any expansion of the number of active engineers. Projections made by the U. S. Office of Education indicate that we shall probably not have a class of 40,000—the *current* annual requirement —until 1963.
- According to Dr. Howard Meyerhoff, executive director of the Scientific Manpower Commission, **there is now a shortage of about 20,000 scientists.** Last year the number of doctoral degrees in the natural sciences, almost a prerequisite for research work, was only 5,000. Dr. Meyerhoff estimates that the shortage of scientists will rise another 30,000 by 1960.

More Needed As Teachers

Not all of the graduates with scientific and engineering training, furthermore, will work as scientists and engineers—that is, by performing research and giving it practical application. Such training is now necessary in many sales and management positions. And more of our technically trained men and women must remain in educational institutions as teachers if the quality of engineering and scientific education is to be maintained. A survey in 1954-55 by the National Education Association showed that, out of 277 universities, state colleges and large private colleges, nearly one-third *already* had unfilled vacancies in engineering and three-fourths had vacancies in physical sciences.

The dimensions of the shortage of scientists and engineers can be summarized as follows: **Despite a substantial rise in the trained manpower available, the needs of industry, the government and education have risen still faster. The best information indicates that, on the basis of current and anticipated needs, our recent yearly rates of production of slightly over 20,000 engineers and about 5,000 PhD's in natural sciences could be doubled without closing the gap entirely.**

The disturbing implications of this shortage for our national security and our prosperity and some practical suggestions for eliminating it will be the subjects of subsequent editorials in this series.

This is one of a series of editorials prepared by the McGraw-Hill Department of Economics to help increase public knowledge and understanding of important nationwide developments of particular concern to the business and professional community served by our industrial and technical publications.

Permission is freely extended to newspapers, groups or individuals to quote or reprint all or parts of the text.

Donald C. McGraw

PRESIDENT

McGRAW-HILL PUBLISHING COMPANY, INC.

MEETINGS CALENDAR

MAY

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS—North Eastern District Meeting, Sheraton Hotel, Rochester, New York, May 2-4.

EDISON ELECTRIC INSTITUTE—Accident Prevention Committee, Coronado Hotel, St. Louis, Mo., May 2-4; Purchasing & Stores Committee, Sheraton Plaza Hotel, Boston, Mass., May 7-9; Commercial Electric Cooking Conference, Sheraton Hotel, Chicago, Ill., May 8; Transportation Committee Meeting, jointly with AGA, Congress Hotel, Chicago, Ill., May 8-11; Industrial Relations Committee, Willis E. Hughes Memorial, Rochester, N. Y., May 17; Orientation Meeting, jointly with AGA, Headquarters, New York, N. Y., May 21.

NATIONAL FARM WIRING CONFERENCE—LaSalle Hotel, Chicago, Ill., May 3-4.

PENNSYLVANIA ELECTRIC ASSOCIATION—Hydraulic Power Committee, Hotel Warwick, Philadelphia, Pa., May 3-4; System Planning Committee, Hotel Alexander, Hagerstown, Md., May 7-8; Transmission and Distribution Committee, Skytop Lodge, Skytop, Pa., May 10-11; Communications Committee, Nittany Lion Inn, State College, Pa., May 14-15; Relay and Electrical Equipment Committees, Hotel Roosevelt, Pittsburgh, May 17-18; *Industrial Sales Conference, Galen Hall, Wernersville, Pa., May 17-18; Annual Accounting Conference, Warwick Hotel, Philadelphia, Pa., May 21-22; Systems Operations Committee, Bedford Springs Hotel, Bedford, Pa., May 24-25.

NATIONAL ASSOCIATION OF RAILROAD AND UTILITIES COMMISSIONERS—Executive Committee, Leamington Hotel, Minneapolis, Minn., May 4.

AIR-CONDITIONING & REFRIGERATION INSTITUTE—Annual Meeting, The Homestead, Hot Springs, Va., May 7-9.

AMERICAN WELDING SOCIETY—Fourth Welding Show, Memorial Auditorium, Buffalo, N. Y., May 9-11.

ATOMIC INDUSTRIAL FORUM, INC—Hotel Plaza, San Antonio, Texas, May 10-11.

NORTHWEST PUBLIC POWER ASSOCIATION, INC—Engineering & Operations Section, Cascadian Hotel, Wenatchee, Washington, May 10-11.

PUBLIC UTILITIES ADVERTISING ASSOCIATION—Annual Convention, Philadelphia, Pa., May 10-11.

INTERSTATE POWER CLUB—Hotel Martinique, New York City, N. Y., May 14.

PACIFIC COAST ELECTRICAL ASSOCIATION—Annual Convention, Las Vegas, Nevada, May 14-16.

***PETROLEUM ELECTRIC POWER ASSOCIATION**—28th Annual Convention, Robert Driscoll Hotel, Corpus Christi, Texas, May 14-16.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS—Design Engineering Conference, concurrent with Design Engineering Show, Convention Hall, Philadelphia, Pa., May 14-17.

ILLINOIS INSTITUTE OF TECHNOLOGY—Industrial Nuclear Technology Conference, Museum of Science & Industry, Chicago, Ill., May 15-16.

GREAT LAKES POWER CLUB—Wagon Wheel Hotel, Rockton, Ill., May 17-18.

NEW YORK STATE SOCIETY OF PROFESSIONAL ENGINEERS—30th Engineering Industries Exposition with Annual Convention, Statler Hotel, New York City, May 17-19.

INDUSTRIAL HEATING EQUIPMENT ASSOCIATION, INC—Spring Meeting, The Homestead, Hot Springs, Va., May 20-23.

NORTHWEST ELECTRIC LIGHT & POWER ASSOCIATION—Business Development and Personnel Section Meeting, Benjamin Franklin Hotel, Seattle, Wash., May 21-23.

AMERICAN MANAGEMENT ASSOCIATION—General Management Conference, Hotel Roosevelt, New York City, May 23-25.

NATIONAL SOCIETY OF PROFESSIONAL ENGINEERS—Annual Meeting, Ambassador Hotel, Atlantic City, N. J., May 23-26.

CIGRE—16th Annual International Conference, Paris, France, May 30-June 9.

JUNE

EDISON ELECTRIC INSTITUTE—24th Annual Convention, Traymore Hotel, Atlantic City, June 4-6.

NATIONAL ASSOCIATION OF ELECTRICAL DISTRIBUTORS—48th Annual Convention, Ambassador & Chelsea and Ritz Hotels, Atlantic City, N. J., June 11-14.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS—Semi-Annual Meeting, Statler Hotel, Cleveland, Ohio, June 17-21.

AMERICAN SOCIETY OF TESTING MATERIALS—59th Annual Meeting & 12th Apparatus Exhibit, Chalfonte-Haddon Hall, Atlantic City, N. J., June 17-22.

FIFTH WORLD POWER CONFERENCE—Vienna, Austria, June 17-23.

CANADIAN ELECTRICAL ASSOCIATION—Annual Convention, Manoir Richelieu, Murray Bay, Quebec, June 18-20.

NORTHWEST ELECTRIC LIGHT & POWER ASSOCIATION—Accounting & Business Practice Section, Multnomah Hotel, Portland, Oregon, June 21-23.

PUBLIC UTILITIES ASSOCIATION OF THE VIRGINIAS—Accident Prevention Committee Conference, Hotel Roanoke, Roanoke, Va., June 22.

WISCONSIN UTILITIES ASSOCIATION—Accounting Section Convention, Schwartz Hotel, Elkhart Lake, Wis., June 24-26.

MICHIGAN ELECTRIC ASSOCIATION—Annual Convention, Grand Hotel, Mackinac Island, Mich., June 24-27.

***ATOMIC INDUSTRIAL FORUM, INC**—Conference sponsored jointly with Denver Research Institute, Denver, Colo., June 25-26.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS—Summer and Pacific General Meetings, San Francisco, California, June 25-29.

AMERICAN SOCIETY FOR ENGINEERING EDUCATION—Annual Meeting, Iowa State College, Ames, Iowa, June 25-29.

AMERICAN CHIEF ENGINEERS' ASSOCIATION—Northwest Power Show, Minneapolis Auditorium, Minneapolis, June 28-July 1.

JULY

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION—Council Meeting, Geneva, Switzerland, July 16-21.

NATIONAL ASSOCIATION OF RAILROAD AND UTILITIES COMMISSIONERS—Annual Convention, Sheraton Palace Hotel, San Franvisco, Calif., July 24-27.

COLUMBIA UNIVERSITY INDUSTRIAL & MANAGEMENT ENGINEERING DEPARTMENT—Fifth Annual Utility Management Workshop, Arden House, Harriman, New York, July 29-Aug. 10.

SEPTEMBER

***NORTHWEST PUBLIC POWER ASSOCIATION, INC.**—Accounting Section, Cascadian Hotel, Wenatchee, Wash., Sept. 11-14.

***AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS**—3rd Annual Electrical Conference of the Petroleum Industry, Kansas City, Mo., Sept. 12-14.

***PUBLIC UTILITIES ASSOCIATION OF THE VIRGINIAS**—38th Annual Meeting, Greenbrier Hotel, White Sulphur Springs, W. Va., Sept. 14-15.

***EDISON ELECTRIC INSTITUTE**—Industrial Relations Round Table Conference, Drake Hotel, Chicago, Ill., Sept. 17-19; Meter & Service Committee, Purdue University, Lafayette, Ind., Sept. 24-26.

***ILLUMINATING ENGINEERING SOCIETY**—National Technical Conference, Hotel Statler, Boston, Mass., Sept. 17-21.

***INSTRUMENT SOCIETY OF AMERICA**—11th Annual Instrument-Automation Conference and Exhibit, New York Coliseum, Sept. 17-21.

***ATOMIC INDUSTRIAL FORUM, INC.**—3rd Annual Forum Conference and 2nd Annual Trade Fair, Morrison Hotel and Navy Pier, Chicago, Ill., Sept. 24-28.

*Additions this week

CIGRE Paris Meeting Set

June gathering of world experts will hear papers by U. S., other engineers, on latest electric power developments

High voltage power transmission and generation achievement in the United States will be laid before world experts next month at the 16th (biennial) session of the International Conference on Large Electric Systems. It will be held at Paris, France, May 30 to June 9.

U. S. engineers representing electric utility companies and electrical manufacturing firms will author 12 of the 117 technical papers to be discussed. Engineers from 24 other countries, including the Soviet Union, will also present technical papers.

Known by engineers as CIGRE because of its French name—Conference International des Grands Reseaux Electriques—the Paris conference is with one exception (International Electrotechnical Commission) the oldest and largest of all international organizations for the interchange of technical information among nations. CIGRE was founded in March, 1921, and today has 2,000 permanent members from 41 different countries.

Transmission Report Featured

This year at the Paris conference 18 U. S. technical specialists will offer papers covering important new aspects of American power transmission practice. Of particular significance among these will be the reports on the performance of the first 330,000-v power transmission lines in the U. S. Author of this paper is Philip Sporn, president of American Gas & Electric Co.

Sporn, who is president of the U. S. National Committee of CIGRE, is also chairman of the two CIGRE Study Committees headed by U. S. engineers. As such he will also present the report on the "Study Committee on Transmission Lines at Extra High Voltages."

S. B. Crary, manager of the analytical engineering department, General Electric Co, as chairman of the CIGRE Study Committee on Power System Stability and Load Frequency and Voltage Control, will report to the conference on international activity in this field. Crary's report will include four appendices, two by U. S. authors.

Other papers by U. S. engineers will deal with such subjects as: Developments in automatic control of large interconnected power systems, control of high-voltage transmission systems by microwave radio, American practice in the application of high-voltage switchgear, studies in the control of transformer noise, developments in the cooling of large power generators, corona phenomena on high voltage power lines, and the construction of foundations for transmission tower structures.

Attendance at the Paris conference is expected to exceed 1,600 from more than 25 countries. To date the U. S. delegation will exceed 50.

WWP May Buy Citizens' Washington Properties

A 2300-customer utility company is considering selling its Washington State holdings to the Washington Water Power Co and its president says the decision was influenced by the outcome of last November's vote in Stevens County.

Negotiations have begun for the purchase by WWP of properties of the Citizens Utilities Co of Connecticut, which operates an electric system in northern Spokane and southern Stevens counties, near Deer Park.

Deer Park city commissioners will consider repealing a recent ordinance authorizing the town to establish a municipal power system, and instead grant a franchise to WWP.

Kinsey M. Robinson, WWP president, said his firm expects soon to apply to the Washington Public Service Commission for authority to buy the system. He forecast that under WWP "the average residential rate will show a decline of 27%."

Richard Rosenthal, president of Citizens Utilities, said his firm, while not anxious to sell the properties, has been largely influenced by the recent Stevens County vote. Citizens of the county voted in November by a 71% majority to sell their PUD to WWP.

Rosenthal said WWP could operate Citizens Utilities for less than its present costs and that the sale would benefit residents of the area.

S & S Shorts

(*Continued from page* 120)

Still a Good Sales Getter

A "Weather Prophet" contest has doubled clothes dryer sales in the twin-city area, reports Northern States Power Co. More than 14,640 entries were received from contestants who had to predict the high and low temperatures and snowfall on Christmas Day. From this came 2,047 dryer sales during the campaign period, Nov. 1 to Dec. 15. A similar contest in 1954 pulled 1,025 sales.

Sees Good Built-In Future

Built-in oven manufacturers will sell about 300,000 units in 1956, according to E. M. Maines, Hotpoint Co. He says by 1960 sales should reach ½-million units.

Electric Leagues: "On Your Mark"

Nation's electrical leagues got a "get ready" notice for annual electric housewares gift promotion contest early this month from the sponsoring National Electrical Manufacturers Association. Entries should highlight tie-ins with industry's "Be Modern—Give Electric Housewares" theme, are due Aug. 31. Winner's plaque will be given at International Association of Electrical Leagues' meet next fall.

Competitor's Corner

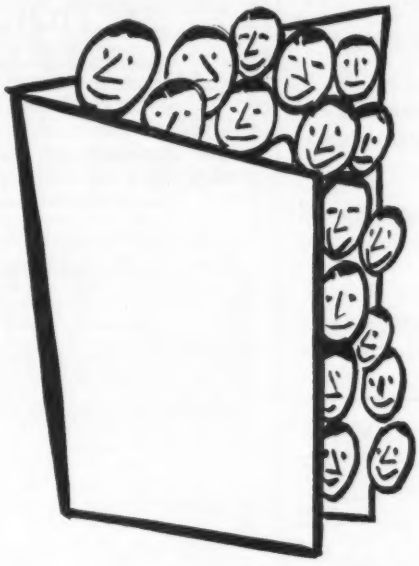
"Fastest Cooking" Battle

Another challenger has jumped ringward to fight an electric range maker's claim one of its new units cooks faster than gas (EW, Jan. 23, p 116).

Caloric Appliance Corp is unlimbering a promotion that says its new gas ranges are the "world's fastest." Based on tests "under normal meal cooking conditions" atop all four of its 12,000 Btu burners, Caloric says it will guarantee faster cooking "without recourse to special wiring or utensils."

Gas A. C.: Cheaper to Run?

More news about Coleman Co's gas air conditioner: Look for the operating cost angle to be given a big play. According to Gas Age magazine, Coleman claims its 3 and 5-ton units can run at less than two thirds the cost of an equivalent electric system. That's including electrical auxiliaries.



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Previous advertising experience not necessary but helpful. Must have at least two or three years of college with courses in engineering and technical subjects and like to write. If you have the qualifications we have an opportunity open for you. Man selected will be trained in all phases of industrial advertising. In your letter of application state age, education, positions held, and give statement of why you want a career in advertising. Location: well-known Connecticut company.

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P-1511, Electrical World
330 West 42nd Street, New York 36, N. Y.

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CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)
LOS ANGELES: 1125 W. 6th St. (17)

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Senior Electrical Engineer. Graduate with eight to fifteen years' experience in power, generation, transmission, and distribution to head electrical design group for medium-sized, nationally-known, western consulting organization. Opportunity for right man to demonstrate qualifications for acquisition of interest in an expanding business. P-1430, Electrical World.

Sales Promotion Man. Management Consulting Firm in midwest has an opening for an alert journalism major, 25-30 years old, with some sales promotion or advertising experience in the utility field. Send detailed resume and salary requirements. P-1513, Electrical World.

Man for maintenance of electric utility electronic equipment. Must be familiar with Carrier Current, supervisory, radio, and transmission line relay and control equipment. To work out of the Algodones Plant, Algodones, New Mexico. Travel within a limited area. Furnish qualifications and desired salary in first letter. Apply Plains Electric Generation and Transmission Cooperative, Inc., 915 Copper N. E., Albuquerque, New Mexico.

Wanted: By Sales Department of major primary aluminum manufacturer. Electrical engineer to help users of aluminum electrical conductors to overcome technical problems and to coordinate customer requirements for aluminum conductors with manufacturing capabilities. Basic requirements: Graduate Electrical Engineer, practical experience with design of electrical power equipment or systems, age preferably between 30 and 40. Salary commensurate with qualifications. Address inquiries to: P-1567, Electrical World.

POSITION WANTED

Jr. Distribution Engineer age 33 desires position with public utility. PW-1565, Electrical World.

SEARCHLIGHT SECTION
(Classified Advertising)
(Continued on opposite page)

OFFICIAL PROPOSALS

Bids: June 5, 1956

Power Authority of the State of New York Advertisement for Proposals

FOR
ELECTRICAL WORK AT THE
BARNHART ISLAND SWITCHYARD
NEAR MASSENA, ST. LAWRENCE
COUNTY, NEW YORK
SPECIFICATION NO. PA-5-14032
ST. LAWRENCE CONTRACT NO. 26

NOTICE TO CONTRACTORS: The POWER AUTHORITY OF THE STATE OF NEW YORK will receive sealed proposals for the electrical work at the Barnhart Island Switchyard near Massena, St. Lawrence County, New York, in the following ways:

(1) If brought in person on the day of receiving bids, until 10:30 A. M. Eastern Daylight Saving Time on the 5th day of June, 1956, 270 Broadway, Hearing Room C on the 6th floor, New York, New York.

(2) If mailed in, until 10:15 A. M. Eastern Daylight Saving Time on the 5th day of June, 1956, at the Authority's office, 270 Broadway, Room 1300, New York 7, New York.

The proposals will be publicly opened and read aloud at the time and at the address given in (1) above.

The work includes but is not limited to the installation of the following Authority furnished equipment consisting of high pressure oil pipe type cable, power circuit breakers, disconnecting switches, lightning arresters, carrier current equipment, metering equipment, insulator assemblies and bus supports for both 115 kv and 230 kv service, autotransformers, metalclad switchgear, unit substations, motor control center, control battery and appurtenances, lighting and miscellaneous power transformers, lighting system and all wire and cable; the furnishing and installing of miscellaneous electrical equipment, exposed conduit and grounding, switchyard buses, line and static conductors, cable trays and clocks; and making electrical connections to equipment of a basically non-electrical nature such as the air compressor insulating oil system; cooling water system; fire protection system and sump pumps.

The work shall be completed on or before December 1, 1959.

Plans, specifications and Proposal Forms for the work will be on file in the Authority's office and in the offices of the Engineer, Uhl, Hall & Rich, 230 Congress Street, Boston 10, Massachusetts, and the Hydro-Electrical Power Commission of Ontario, 620 University Avenue, Toronto 2, Ontario, may be inspected by prospective bidders during office hours, and may be obtained from the Power Authority of the State of New York, 270 Broadway, Room 1300, New York 7, New York, upon application and prepayment of a fee of Twenty-Five ($25.00) dollars, for initial set and Ten ($10.00) dollars for each additional set, no part of which will be refunded.

Bids must be made in duplicate in accordance with instructions contained in the Information for Bidders. Guarantee will be required with each bid in an amount not less than 10 percent of the gross sum bid.

The right is reserved to reject any or all bids.

W. S. CHAPIN
GENERAL MANAGER

U. S. Government

FOR SALE—USED GENERATOR, HYDRAULIC TURBINE, SWITCHBOARD, CRANE, ETC.—Sealed bids (Invitation No. 208A-109-56) will be received until 1 p.m., June 4, 1956, for sale of Prosser Power Plant generating and auxiliary equipment. Principal items are: 2400 kw. 0.8 pf AC generator, 200 rpm, 2400 volts, 3-phase, 60-cycles; direct-connected exciter; generator field circuit breaker; hydraulic turbine rated 4200 hp. at effective head of 40'; governor; control battery; tools and spare parts; power-plant switchboard and auxiliary equipment; 20-ton overhead traveling crane; station service transformers; penstock gate, and hoist. For particulars address the U. S. Department of the Interior, Bureau of Reclamation, P. O. Box 1377, Yakima, Washington.

O. W. Lindgren, Superintendent

WANTED
WATTHOUR METERS
Large Quantities
2 Wire 5 & 10 Amp bottom connected only.
Type OB, OC, CA, 1-16, 1-20, 1-30, JA.
Utilities Write or Call Collect
THE ELECTRICAL WATTHOUR METER CO.
76-15 Woodside Ave. Elmhurst 73, N. Y.
Phone HAvemeyer 9-0131

MOTORS · GENERATORS
TRANSFORMERS
NEW · REBUILT
WORLD'S LARGEST INVENTORY
ELECTRIC EQUIPMENT CO.
PHONE STATION COLLECT GL 6784
P.O. BOX 51 ROCHESTER 1, NEW YORK

OFFICIAL PROPOSALS

Bids: May 29, 1956

Power Authority of the State of New York

ST. LAWRENCE POWER PROJECT
ADVERTISEMENT FOR PROPOSALS
FOR
THE FURNISHING AND DELIVERY OF MAIN SWITCHBOARDS & APPURTENANCES
SPECIFICATIONS NO. PA-5-14016
ST. LAWRENCE CONTRACT NO. P38

NOTICE TO CONTRACTORS: The POWER AUTHORITY OF THE STATE OF NEW YORK will receive sealed proposals for the design, manufacture and furnishing of the Main Switchboards, consisting of one Main Control and Relay Board of 27 panels, one Station Service Control and Main Recorder Board of 10 panels, four (4) Generator Differential Relay Boards and one (1) Transmission Line and Station Service Metering Board of 3 panels, together with appurtenances and accessories, and the delivery thereof, f.o.b. the Authority's classification yard, Massena, New York, as follows:

(1) If brought in person on the day of receiving bids until 10:30 A.M. Eastern Daylight Saving Time on the 29th day of May, 1956, 270 Broadway, Hearing Room C, 6th floor, New York, New York.

(2) If mailed in until 10:15 A.M. Eastern Daylight Saving Time on the 29th day of May, 1956 at the Authority's Office, 270 Broadway, Room 1300, New York 7, New York.

The proposals will be publicly opened and read aloud at the time and at the address given in (1) above. Bids will be entertained for the control, relay, recorder and metering boards, accessories and services in accordance with the bidding schedule. Erection at the site of installation will be done by Others but services of erecting engineers shall be provided by the manufacturer if and when required. Delivery of all switchboards, appurtenances and accessories will be required June 1, 1957.

Plans, Specifications and Proposal Forms for the work will be on file in the Authority's office and in the offices of the Engineer, Uhl, Hall & Rich, 230 Congress Street, Boston 10, Massachusetts, and The Hydro-Electric Power Commission of Ontario, 620 University Avenue, Toronto 2, Ontario, may be inspected by prospective bidders during office hours, and may be obtained from the Power Authority of the State of New York, 270 Broadway, Room 1300, New York 7, New York, upon application and prepayment of a fee of Ten ($10.00) dollars for initial set of Contract Documents and Five ($5.00) dollars for each additional set, no part of which will be refunded. Two sets must be returned with each bid.

Bids will not be restricted to American manufacturers.

Bids must be made in duplicate upon the proposal forms included in and bound with the Contrat Documents. Bid deposit will be required with each bid in an amount not less than 10 percent of the gross sum bid.

The right is reserved to reject any or all bids.

GENERAL MANAGER
W. S. Chapin

TRANSFORMERS
SPECIAL PURCHASE
five carloads
13800 volt transformers
sizes 25 KVA to 250 KVA
new and slightly used
What can you use?
Write for list and prices
Many other items in stock
TRANSFORMERS WANTED
Reliable rewind and repair service on all makes of transformers
THE ELECTRIC SERVICE CO.
5316 Hetzel St.
Cincinnati 27, Ohio
40 Years' Dependable Service

FOR SALE
SUBJECT TO PRIOR SALE
200 Westinghouse Type CO, Inverse Time Relays, Rated 0.5/2.5 Amperes, 60 Cycle, with Universal Operation Indicator. In Modern Flexitest Cases Which Can Be Mounted Either Flush or Projection. All In First Class Condition. Can Be Used Interchangeably. Styles Nos. 1271197, 1273197, 1545024 and 1545012. If Interested Contact N. C. Stirewalt, V. P., Central Illinois Public Service Company, Springfield, Illinois.

SUBSTATION EQUIPMENT
TRANSFORMERS

QU.	KVA	MFGR.	VOLTAGE
3	1000	Mol.	110,000—460
4	2500	Mol.	66000—13,800
3	1500	G.E.	66000—2400/4160
3	200	Pitts.	66000—2300
3	1500	Wag.	44000—6900/11950
3	1250	A.C.	44000/11500—460
3	200	West.	44000—480
3	75	West.	44000—7200/12470Y
3	5000	G.E.	38100/66000—6600
4	3333	G.E.	38100/66000Y—33000
4	3125	Mol.	39900/66000Y—26600/46000Y
3	3333	G.E.	33000/11000—2400/7200
1	3000	A.C.	34500—2400/7200/12470Y, 3ph
2	3000	Stand.	33000—4160, 3 ph.
1	2500	A.C.	34500—13800, 3 ph.
1	2000	Kuhl.	33000—6900, 3 ph.
3	1500	A.C.	34500—2300
3	667	A.C.	33000—2400/4160Y
3	200	A.C.	34500—2400/7200/12470Y
3	200	G.E.	34500—120/240
3	75	West.	33000—240/480
2	3750	G.E.	26400—4360/2520, 3 ph
4	1500	A.C.	25400/44000Y—6900/1380
3	333	G.E.	22800/13200—2400
3	100	G.E.	22000—7200/12470Y
3	50	G.E.	22000—2300
2	3000	G.E.	13800—600, 3 ph. Unit Sub.
3	1200	West.	13800—600, 3 ph. Unit Sub.
1	1000	West.	13200—2300, 3 ph. Unit Sub.
1	600	Stand.	13200—2300, 3 ph.
1	450	Penna.	13200—2400, 3 ph. ASKAREL
3	200	G.E.	13200—2400
3	125	A.C.	6900—2300
3	333	G.E.	2400/4160Y—460
3	250	Mol.	2400—240/480
3	200	West.	2400—240/480
3	150	West.	2400—230/115
3	100	G.E.	2400/4160—120/240
1	100	G.E.	2300—575, 3 ph.
6	50	West.	2400—114/228, Dry Type

ALSO: FREQUENCY CHANGERS
MOTOR GENERATOR SETS
SYN. CONDENSERS
OIL CIRCUIT BREAKERS
FEEDER REGULATORS, ETC.

BREW, WOLTMAN & CO., INC.
52 Church St., New York 7, N. Y.

FOR SALE
RISE SHUNT REACTORS

1—WEMCO	3000 KVA	34.5 KV	TYPE OA	3 Ph	60 Cyc
1—WEMCO	2000 KVA	34.5 KV	TYPE OA	3 Ph	60 Cyc
1—WEMCO	1500 KVA	24.9 KV	TYPE DA	3 Ph	60 Cyc
1—WEMCO	1500 KVA	24.9 KV	TYPE DS	3 Ph	60 Cyc

Location, Western South Dakota. All approximately three years old. In excellent condition. For further information write

RUSHMORE G & T ELECTRIC COOPERATIVE
Route 2, Box 92 Rapid City, S. D.

DIESEL ENGINES — POWER MACHINERY
DIESEL GENERATOR SETS—Stationary—Portable—Mobile
MOTORS and GENERATORS—100 KW to 1500 KW
A. G. SCHOONMAKER COMPANY, INC.
Main Office Box 516, Sausalito, Calif. Sausalito 1600
Branch 50 Church St., N. Y. 7, N. Y. Digby 9-4350

LARGE POWER EQUIPMENT
Prompt Stock Shipment
RENUBILT MOTORS - GENERATORS
TRANSFORMERS - CIRCUIT BREAKERS
DO YOU GET OUR STOCK LIST?
BELYEA COMPANY INC.
51 Howell St. Jersey City, N. J.

FOR SALE
Eight Condit Type "08" CIRCUIT BREAKERS
7500 Volt, 400 Amps., 50,000 KVA Rating on a CO-2 min-CO Duty Cycle. Manufactured 1936. In Good Operating Condition. If interested contact N. C. Stirewalt, V.P., Central Illinois Public Service Company, Springfield, Illinois.

ELECTRICAL
WIRE AND CABLE
—YOUR BEST SOURCE—
• for every industrial and power application
• Odd lengths—long and short—reasonably priced
One of the Largest Stocks in the Midwest
Let us quote on requirements—
send your inquiries
We'll also buy your Surplus
Branch Office:
Houston—Walnut 3-4580
FOR YOUR TEMPORARY NEEDS TRY OUR SURPLUS DIVISION
UNIVERSAL WIRE and CABLE Co.
2929 N. Paulina St. Chicago 13, Ill.
EAstgate 7-4777 Code: UNIWIRE

Greasepaint, Skits, Company Story . . .

. . . Spark Pacific G&E Road Show

A 1½-hr road show, "There's No Business Like Our Business," is touring a 1,600-mi Pacific Gas & Electric Co circuit of 15 cities. Designed to reach most of its 17,000 employees, their families, and retirees, it tells of PG&E's activities and gains, gives an idea of what the future holds.

The show, staged by the advertising and publicity department, aims to foster pride in company, emphasizes objective voiced by Pres Norman Sutherland—"Not to be the biggest, but the best."

One production feature is a sound movie introducing PG&E officers who discuss plans for the utility's future at meeting of President's Advisory Committee. Sutherland, in the film, tells employees "You are responsible for our good public service, for our business success, and for our progress."

Entertaining skits praise departments and divisions for good work (50% sales revenue hike by sales department, employee rescue work during floods); salute workers active in civic affairs; and dramatize electric service (pumping enough irrigation water to fill 2½ Shasta Dams). Cast, shown above, is made up of employees.

Eight Remedies Offered for Poor Communication

In a general blast at utility employee magazines, C. B. Boulet, Wisconsin Public Service Corp., criticised lack of interpretive reporting on company benefits and the public power menace. At recent Southeastern Electric Exchange, Boca Raton, Fla., he suggested these steps of how management can improve communications:

1. Emphasize importance of communications to company's success.

2. Formulate objectives so those in communications work know what is to be done during next 12 months.

3. Determine how much information employees have now.

4. Plan the program to utilize the most effective of the 30-40 avenues of communication for each objective.

5. Make certain you have a responsible person directing the program, preferably a qualified one from the personnel department.

6. Don't hamstring the communications man by insisting copy must be cleared by executives.

7. Stimulate employees to use open channels to top management.

8. Plan the timing of information released.

Utility Hires Ad Agency

Southern California Edison Co announced last week it has signed a contract with Young & Rubicam, Inc's Los Angeles office to do advertising.

PR&A BRIEFS

• With deadline for the Reddy Kilowatt Annual Report Contest 12 days away (May 12), the awards committee is getting set for a big last-minute rash of entries. New contest features will be recognition for top entries and a certificate for report showing most improvement over 1954.

• Central Hudson Gas & Electric Corp brightened annual stockholder meeting with 30-min color slide film highlighting 1955 activities.

MILLIONS OF FEET NOW IN SERVICE

BECAUSE OF PROVED PERFORMANCE

ROCKBESTOS PNR SMALL DIAMETER CONTROL CABLE

There are still a few who haven't yet taken advantage of PNR . . . the lighter, smaller control cable. But it's come a long way since we first introduced its Polyethylene, Nylon, Rockhide insulation to industry just six short years ago.

Today, many utilities specify it. And there are millions of feet in service.

If you haven't tried it yet, get the complete PNR story today. Write or ask your nearest Rockbestos representative.

*Average determined by comparison with conventional control cable.

PROPERTIES OF PNR

46% smaller in area* . . . 28% smaller in diameter* than conventional control cable.
Use smaller conduit and fittings or put more conductors in existing conduit.
Lighter, easier to handle, store, ship, pull through conduit.
Dielectric breakdown . . . over 40 times operating voltage.
Rated 600 volts . . . conductor operating temperature 167°F.
Flexible from 167° to —67°F.
No cracking!

ROCKBESTOS PRODUCTS CORPORATION
NEW HAVEN 4, CONN.

NEW YORK • CLEVELAND • DETROIT
CHICAGO • PITTSBURGH • ST. LOUIS
LOS ANGELES • NEW ORLEANS
OAKLAND, CALIFORNIA

Utility Money Costs Still Go Higher

(*Continued from page* 61)

of the districts have already gone to 3%. Dealers in bankers' acceptance have moved their rates up ⅛ of a percentage point. Interest on prime commercial short-term bank loans has climbed to 3¾%, and money has become so tight that a few banks are rationing these loans.

This is the season when, perenially, short term rates reflect demand for money to pay income taxes. It might be well for the electric industry not to do too much "financing" around income tax time.

Business Boom Continues

The business "boom" is continuing; so political pressure, in a presidential election year, is to endeavor to prevent "boom and bust" by upholding firm money rates.

Total utility funded debt issues for April and May (including those already offered and those scheduled in that period) add up to over $350 million. Even allowing a slowdown in the summer months, this indicates an annual rate of nearly $2 billion for these offerings—well over normal. For the first quarter of 1956, the industry sold publicly only $142 million in bonds. All were "new money." This is shown in table prepared by Reis & Chandler, Inc, on page 61. Going beyond these schedules it is understood $250 million of American Telephone & Telegraph Co debentures are scheduled for June. General Electric Co is planning a $300 million debenture issue and Kaiser Aluminum & Chemical a $120 million debenture issue in the second quarter. Thus no cessation of a substantial supply of new funded debt issues is indicated for some time to come unless there should be widespread deferrals of substantial amounts to await happier days in the bond market.

Issue Rescheduling Suggested

It is possible that some rescheduling of electric utility offerings, worked out on a cooperative basis by the companies affected, might relieve market pressure by spreading out the supply of new bonds over a greater period and avoiding several large offerings in a short space of time. Such adjustments of timing seem well worth exploration. EW in its next issue will carry about four months of the "Financing Calendar" furnished by the Irving Trust Co which should help.

All this adds up to the reasonable anticipation that firm rates for electric utility bonds are likely to continue for several months. Under pressure of phenomenal supply of funded debt with demand lessened by continuing mortgage investments, yields even higher than present ones may be witnessed in the near future.

Raise Capital as You Go

As a general axiom it seems a sound concept that electric utilities should raise their capital "as they go" and not try to look into a crystal ball to predict future trends in capital costs. This concept is underscored by the uncertainties which make prediction unusually difficult at this particular time.

Nevertheless, recent history shows that electric utility funded debt interest yields do customarily fluctuate within a fairly definite broad range. The limits of this range may, therefore, serve as guideposts in timing forthcoming financing. For example, whenever the yield on A-rated bonds of electric utilities falls below 3.25% it seems indicated that the time has come to sell bonds necessary to meet corporate needs both in the immediate and even more distant future. Contrariwise, when A-rated bonds yield 3.75% or more, deferral of action merits consideration. At such a level lower yields become a reasonable expectation in the not distant future. In the peak-yield period of late spring and early summer of 1953, when yields for the A's rose to 4.20%, these yields persisted above 3.75% only a few months. So when these exceptionally high or low bond yields occur, it may be wise to consider making an exception to the general concept of raising senior funds as needed.

Take 'Watch and See' Attitude

Companies deferring scheduled offerings or delaying action on projected funded debt issues may receive the benefits of considerably lower yields. Where companies can arrange to delay action for as long as six months, the odds would seem to be in their favor if yields on A-rated bonds are running at 3.75% or thereabouts with bonds in other ratings to match. Opinions may differ as to where this high point is reached. Some may prefer 3.625%; others may even prefer as high as 4%.

There are many who feel that with present high income tax rates, interest rates are more a matter of pride and prestige of management than of important economic impact. But despite the high taxes, a ¼% interest differential makes a gain or loss of $625,000 after taxes at 50% on a $20 million bond issue with a 25-year life, and in proportion for issues of other amounts.

Triple 'A' Interest Rate Up

Evidence that the rise in interest yields has not been confined to bonds with lower ratings is amply evidenced by recent offering of an issue of triple A-rated utility bonds on a 3.35% basis and more recently, by a Aa rated issue on a 3.66% basis.

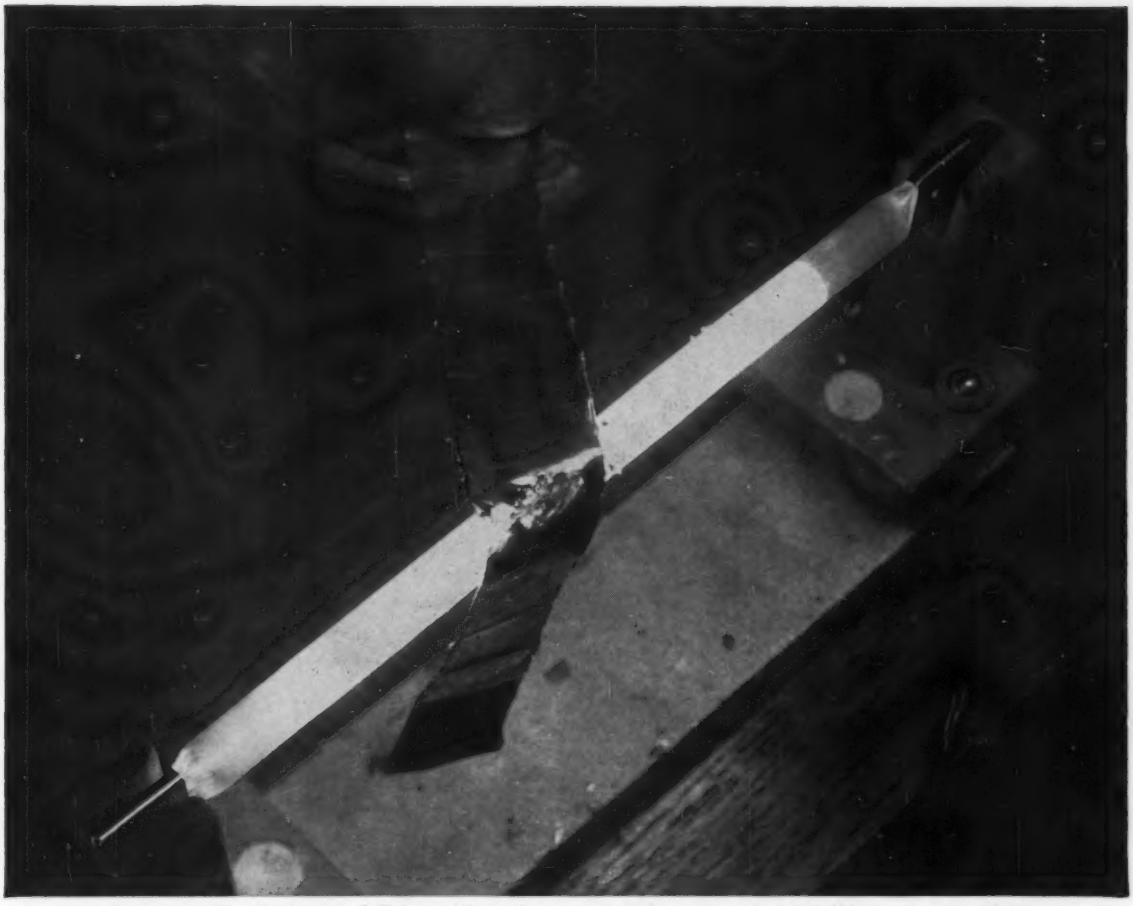
The recent dearth of offerings of preferred stocks of electric utilities has prevented a substantial test of this market. Preferred stock sales of the electric industry for the first quarter of 1956 totaled $61.2 million. Yields have risen but to date not as radically as on funded debt. Forthcoming issues in the near future may create a supply sufficient to affect these dividend rates proportionately.

Preferred Market Is Undecided

Deferral of preferred stock issues involves greater risk than deferring bond sales. Market conditions may become so unfavorable as to make new preferred stock offerings prohibitive from a practical standpoint. Conceivably these conditions might make it difficult to market the preferred stock at any price. These conditions are unlikely to occur in relation to funded debt, thus warranting greater flexibility in timing for bond issues. On the other hand impact on common stock earnings from higher preferred stock dividend rates is greater because no part thereof can be absorbed in federal income tax deductions.

As to electric utility common stock equities, the "green light" still continues to shine as it has for more than a year. While nothing appears in the immediately offing that seems likely to reduce prices of electric utility common stocks drastically, neither does there seem any reason for deferring desirable common stock financing. A year ahead still doesn't seem too far to raise funds in this category. Common

(*Continued on page* 170)



Shown here melting aluminum, the G-E Quartz infra-red lamp can provide heat concentrations up to 1000 watts per square inch.

SMALLEST, HOTTEST, FASTEST electrical heat source available . . . the new General Electric Quartz infra-red lamp

Here's a lamp you can recommend where a powerful compact heat source is required

Heat concentrations 20 times that delivered by previous infra-red sources are possible with the new G-E Quartz infra-red lamp. Hot enough to melt aluminum! So rugged it won't crack under ice water when it's red hot! Entirely new uses are foreseen for this extremely powerful and compact energy source. Bulky equipment can be reduced in size. Here are but a few of many applications in a wide variety of fields where the new G-E Quartz infra-red is already being used:

INDUSTRY—Because of the lamp's extremely fast warm-up, and its compactness, it is being used by manufacturers to heat gears and other metal parts for shrink fitting. In textile mills it is used to speed drying operations, thus contributing to increased productivity.

CAFETERIAS—Where food has to be heated rapidly for large groups—such as in plant cafeterias—the G-E Quartz infra-red can clear bottle-necks by speeding service.

LABORATORIES—Several major aircraft laboratories are using the G-E Quartz infra-red to simulate the heat produced on aircraft surfaces by supersonic flight.

OFFICES—The high concentration of heat from the G-E Quartz infra-red has been responsible for the development of a more compact duplicating machine that provides sharp reproduction, simply and in a matter of seconds.

For your customers who are looking for a truly powerful source of heat or infra-red energy, you can suggest the General Electric Quartz infra-red with full assurance that you are recommending one of the most reliable and versatile tools available today.

For more information write General Electric Large Lamp Dept. EW-4, Nela Park, Cleveland 12, Ohio.

Progress Is Our Most Important Product

GENERAL ELECTRIC

stock sales to the public amounted to $45.4 million for the first quarter of 1956. Total offerings of electric utility securities for the first three months of 1956 amounted to $248.6 million as compared with $426.2 million in the like quarter of 1955. Electric utilities sold more preferred stock in the 1956 quarter than they did in the 1955 quarter.

Source of Expansion Funds Asked by SEC

For the first time in making its survey of business plans for spending, the Securities and Exchange Commission asked companies where they plan to get money for future plant and equipment outlays. Only corporations are permitted to issue securities, and most of these are manufacturing or utilities concerns; so they were the only ones solicited for this information. Returns were high; for instance, 60% among utilities replied.

It must be kept in mind that, although replies ran high, the figures are preliminary. SEC asked the firms in its regular survey of business budgets (SEC Form R-3B) how much money each expected to obtain through stock issues or long-term borrowings during 1956, and the type of financing: stocks, bonds, bank loans, etc.

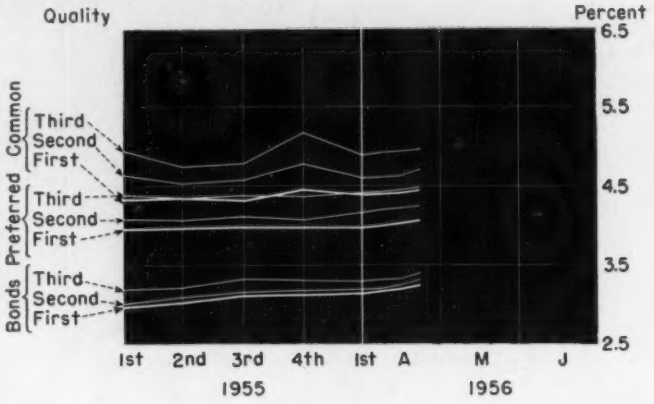
The SEC figures show that corporations will spend an estimated $33.5 billion in 1956, of which $25.5 billion will come from internal sources and $8 billion externally. Of the $8 billion to be financed, corporations will get $1.5 billion from the sale of stocks: $4.5 billion from bonds, and $2 billion from banks and mortgages. Electric gas and water companies alone will sell $2.8 billion in corporate securities in 1956, the SEC survey shows.

FINANCIAL BRIEFS

Detroit Edison Co will need around $60 million of "new money," Edward M. Spencer, assistant treasurer, said.

Boston Edison Co has named May 8 for a special meeting of stockholders to act upon a proposal to increase the capital stock by issuing a first series in the utility's history of $100 par cumulative preferred stock. This is not to exceed $18 million.

Today's Utility Yields (%)



QUALITY.....	BONDS			PREFERRED STOCKS			COMMON STOCKS		
	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd
April 19.....	3.25	3.31	3.43	4.07	4.25	4.49	4.46	4.70	4.97
April 12.....	3.20	3.24	3.33	4.03	4.22	4.47	4.41	4.63	4.95

Utility Earnings

COMPANY	PERIOD MONTHS ENDED		NET INCOME 1955	NET INCOME 1954	EARNINGS PER COMMON SHARE 1955	EARNINGS PER COMMON SHARE 1954
Arkansas Power & Light.....	12	Dec.	$7,343,780	$8,507,485	$....	$....
Carolina Power & Light.....	12	Dec.	9,368,984	7,846,241	1.70	1.63
El Paso Electric.....	12	Dec.	2,170,696	2,158,256	2.43	2.43
Florida Power & Light.....	12	Dec.	13,755,271	10,678,718	2.05	1.75
Oklahoma Gas & Electric.....	12	Dec.	8,367,000	6,975,000	2.34(a)	2.18(a)
Southern California Edison....	12	Dec.	29,172,504	26,618,255	3.22(a)	2.95(a)

Notes— All the figures shown above have been audited; (a) Based on shares outstanding at end of each year.

Utility Financing

COMPANY AND DESCRIPTION	AMOUNT OF OFFERING (000)	OFFERING PRICE	YIELD TO PUBLIC
APRIL 19–25			
BONDS			
Wisconsin Electric Power—1st mtg 3¼% due 1986.....	$30,000	101.875%	3.77%
SCHEDULE FOR APRIL–MAY			
BONDS			BID DATE
Duke Power—1st mtg due 1986.....	$30,000	.....	May 1
California-Oregon Power—1st mtg due 1986.....	16,000	.....	May 8
Niagara Mohawk Power—1st mtg due 1986.....	30,000	.....	May 8
Savannah Electric Power—1st mtg due 1986.....	4,500	.....	May 9
Pennsylvania Electric—1st mtg due 1986.....	12,500	.....	May 15
Consolidated Edison of New York—1st mtg due 1986..	30,000	.....	May 22
PREFERRED STOCK			
Long Island Lighting—120,000 sh $100 par cum.....	$12,000	.....	April 26(a)
California-Oregon Power—70,000 sh $100 par.....	7,000	.....	May 1(b)
El Paso Electric—20,000 sh no par.....	2,000	.....	May 1
Pennsylvania Electric—90,000 sh $100 par cum.....	9,000	.....	May 15
COMMON STOCK			
Wisconsin Electric Power—463,641 sh (to be offered commonholders on 1-for-10 basis, record April 24 to expire May 15 with an oversubscription privilege)...	.....	.....	.....
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Notes — (a) Postponed because of "present unsatisfactory market conditions; (b) Blyth & Co—First Boston Corp, underwriters.

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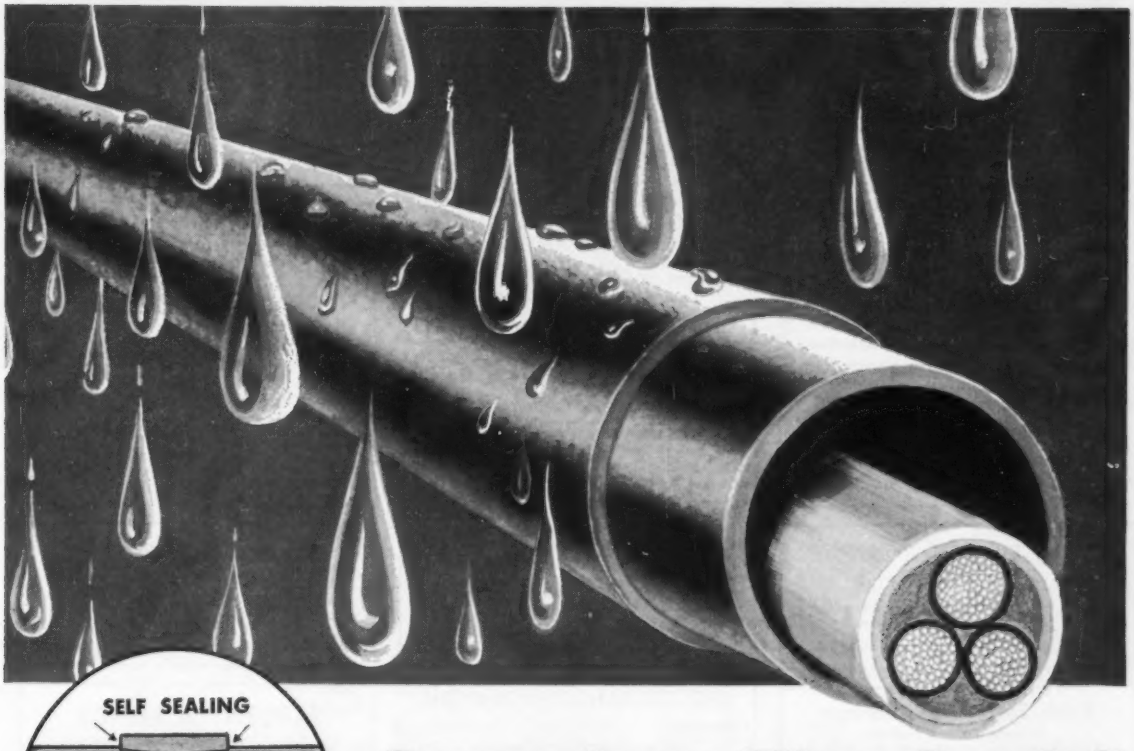

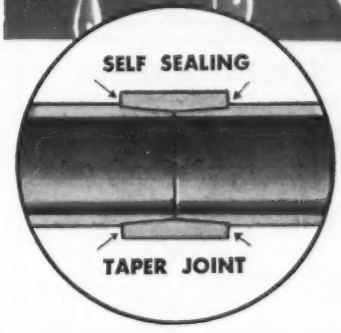

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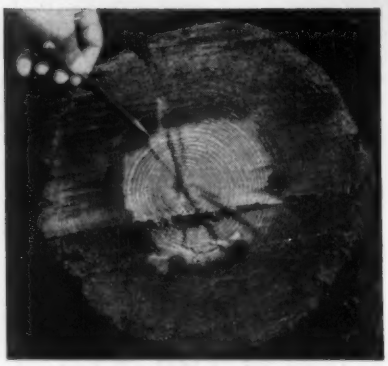

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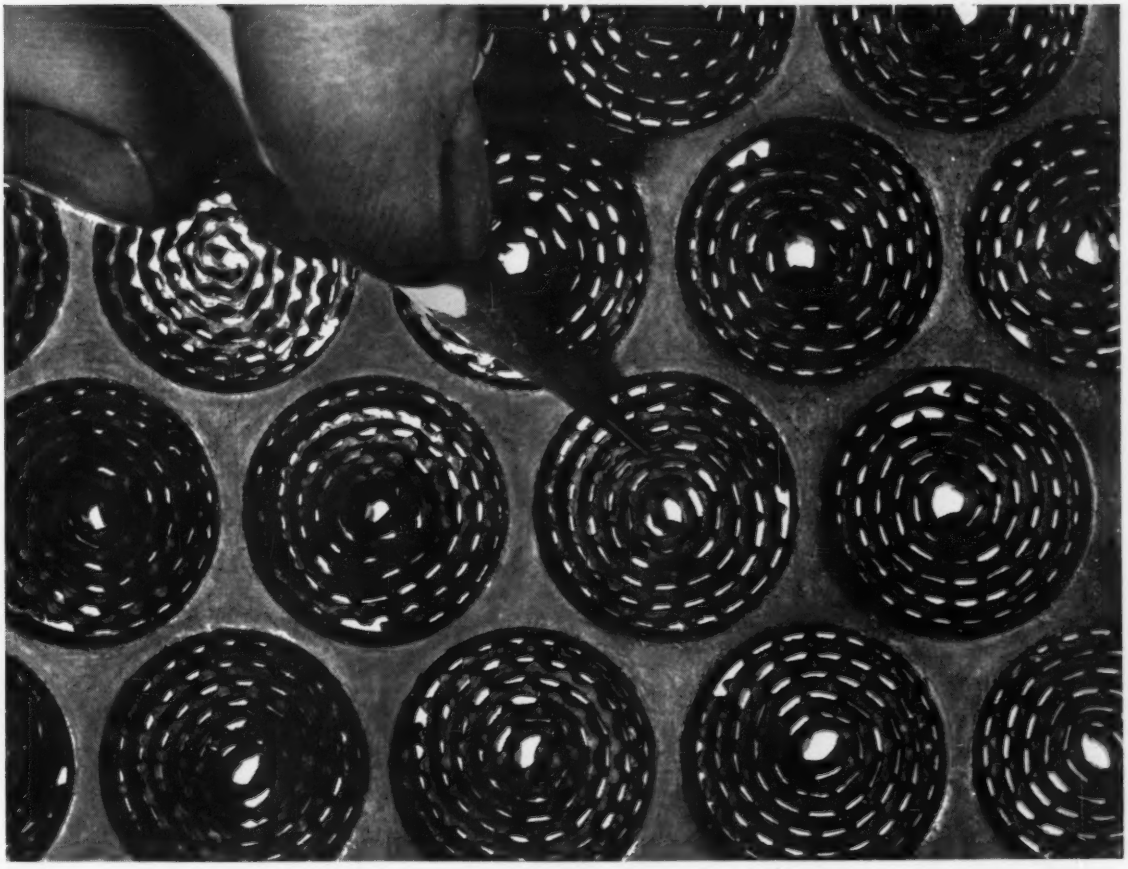

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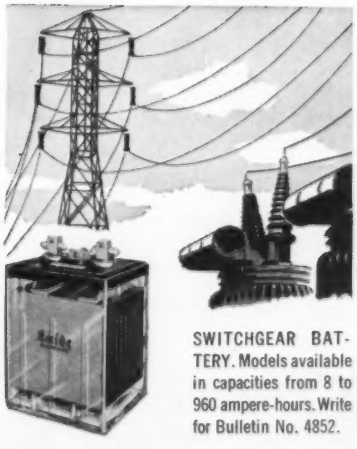

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